THE EQUINOX AND OBLIQUITY OF THE ECLIPTIC FOR 1885.5

AND

THE CONSTANT OF THE LUNAR EQUATION

FROM

OBSERVATIONS MADE UPON THE REPSOLD MERIDIAN CIRCLE
OF THE STRASSBURG OBSERVATORY,
1883–88

Inaugural dissertation, der mathematischen und naturwissenschaftlichen Facultät der Kaiser-Wilhelms-Universität Strassburg zur Erlangung der Doctorwürde vorgelegt von

HENRY ALLEN PECK

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SYRACUSE, N. Y., U. S. A.

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THE EQUINOX AND OBLIQUITY OF THE ECLIPTIC FOR 1885.5, AND THE CONSTANT OF THE LUNAR EQUATION.

Introduction.

One of the fundamental necessities of the science of exact Astronomy is a correct knowledge of the position of the equinoctial points and of the obliquity of the ecliptic. They are the basis of all determinations of absolute right-ascensions of the heavenly bodies and of computations having for their object the fixing of the orbits of the solar system. If we know the right-ascension of some fixed point or system of points, the sidereal interval elapsing between the meridian passage of one of the fixed points and any other object will at once furnish the right-ascension of the latter. In the present state of the science the error of this fundamental system of right-ascensions may be treated as a differential and the problem reduces itself to the best means of finding this value.

Observations of the sun and planets afford the only means as yet of solving the problem. We determine the right-ascension of the sun by observing the sidereal interval elapsing between its transit and that of one of the points or stars of the fundamental system. Evidently this determination will be affected by the common error of the system. But at the same instant in which one coördinate is determined, we may determine the other, the declination, from the measured zenith distance. Apart from errors of observation, and under the supposition that the sun's path is a great circle, a right-ascension computed from this must agree with that directly observed. Is there a difference, it must be due to the error of the equinoctial points and of the value of the obliquity of the ecliptic used in the computation, and from the equation between these different quantities these errors may be deduced. Since, however, the sun's coördinates are variable, each transit furnishes a new equation and these have varying weight for the purpose in hand.

The problem has to-day reached such a stage in its solution that the systematic errors affecting the observations become of the greatest moment, and, in fact, in a series by a single observer or made at a single observatory may, and often do, totally obscure the real values sought. These errors may pertain to the observer, his difference in perception of the transit of a point-like star and of a disc-like body as the sun or his constant error in measuring zenith distances; they may pertain to the instrument and the unequal heating effect of the

solar rays at different seasons of the year; they may arise from a lack of knowledge as to corrections to be applied for circumstances outside of both instrument and observer, as for example, refraction; and finally, after all known sources of error are taken into account, there may remain obscure sources whose influence is often clearly seen when the results of two different observatories are compared. The only practical method of eliminating these is to unite the results of a large number of series so that with respect to the general mean, the systematic errors of the single observers shall rank as accidental. It becomes of interest then that all opportunities shall be seized for an exact discussion of solar observations whenever possible. As a contribution to this grand total, the following with regard to the Strassburg observations for the period 1883–8 is offered.

The Observations.

The observations are those contained in the first and succeeding, yet unpublished, volumes of the *Annalen der Strassburger Sternwarte* for the interval January 1883 to April 1888 inclusive. The observers were Prof. Dr. Schur, Prof. Dr. Wislicenus and Herr Kaufman. The observations of Prof. Wislicenus for 1884 have been omitted as his star observations show that in the period between this date and the spring of 1886 when he again began to make solar observations, his personal equation had undergone quite a change, a change whose effect it is impossible to estimate on account of the small number of solar observations available. The observations have been compared with the *Berliner Jahrbuch* and the deviations of the ephemeris from the theory and formulae of Leverrier have been taken into account at the proper place. The value of the solar parallax used is $8''.81$, and the variation of the latitude has been corrected according to the formula (52) given by Dr. Chandler in his papers in the *Astronomical Journal*,

$$\varphi - \varphi_0 = -r_1 \cos[\lambda + (t - T_1)\theta] - r_2 \cos(\lambda + \odot - G)$$

where the following table of values of θ r_1 r_2 and G_0 were used:

	θ	r_1	r_2	G_0		θ	r_1	r_2	G_0
1882 Dec. 30.7	°	″	″	°	1886 July 3.4	°	″	″	°
	0.842	0.185	0.137	321.8		0.846	0.180	0.144	336.1
1884 March 2.2		0.184	0.139	326.8	1887 Sept. 2.0		0.177	0.146	340.4
	0.843					0.847			
1885 May 3.1		0.182	0.142	331.5	1888 Oct. 31.0		0.174	0.147	344.5
	0.844								

This expression is deduced by Dr. Chandler from nineteen series of observations made between the years 1828 and 1892. Among these are contained the results obtained by Professor Becker from his first two and one-half years' observations by the Talcott method, and whose close agreement with Dr. Chandler's formulae (15), (47) and (48), he has pointed out in *A.N.* 3209.

It will be observed that the observations are in two sections. September 10, 1886, the position of the ocular and objective were interchanged to eliminate the flexure in accordance with an idea originated by the elder REPSOLD, and recommended by HANSEN in *A.N.* 389. Since the method is not directly applicable to a body having variable coördinates, the observations must be rendered homogeneous by correcting for flexure. If the zenith distance corrected for flexure is given by the equations,

$$Z = Z_0 - \alpha \sin Z_0 - \beta(1+\cos Z_0) \quad \text{Circle West}$$
$$Z = Z_0 - \alpha \sin Z_0 + \beta(1+\cos Z_0) \quad \text{Circle East}$$

the provisional values of the constants for the two positions as determined by collimator and nadir observations, and furnished by the Observatory, are,

$$\text{I} \quad \alpha = -0''.23 \quad \beta = +0''.14 \qquad \text{II} \quad \alpha = +0''.08 \quad \beta = +0''.04$$

While in general the personal equation in the nadir estimation has been eliminated by reversal of the image with reference to the observer, or by observations from both the north and south sides of the instrument, a few of Professor SCHUR'S observations in 1883 were made with reference to a nadir point measured from one side of the instrument only. In *A.N.* 2736 he has given his personal equation for such observations. I have repeated his computations, using all his nadir observations made while in Strassburg, and find that while obtaining the same result for the years 1884–5, the presence of a personal equation is not to be discovered prior to May, 1884. The observation journal shows that during this month the instrument was dismounted and the isolation of the piers improved. It seems more probable that the personal equation was obscured previous to this time, than that it should have changed so suddenly in the case of so experienced an observer as Professor SCHUR. However, no correction for this cause has been made in the observations of the year 1883.

The declinations were originally corrected for refraction by means of a thermometer contained in a metallic box surrounded by lattice work, and situated in the open air at the north side of the observing room 1.3 meters from the side wall, and 6.0 meters above the surface of the earth. Subsequent investigations have shown that on account of a lack of sufficient atmospheric circulation, the thermometer always recorded too low temperatures at noon, and did not respond quickly to changes in the condition of the air. Two series of corrections have been found, and corresponding to these, three hypotheses have been made in the equations for the corrections to the Equinox and the Obliquity of the Ecliptic, in order to determine the effect of each on the result. The absolute terms are denoted by N, N' and N'', where N denotes the value when the declinations are corrected according to the readings of the original thermometer, and N' when the correction is made by means of the so-called Aspiration thermometer of Professor ASSMAN. This instrument is so constructed that by

means of clockwork a constant circulation of air is produced in the small box containing the thermometer. N'' denotes the value when the declinations are corrected according to the readings of a sling thermometer obtained in a manner indicated below.

Comparisons with the Aspiration thermometer, ranging over an entire year, show the following corrections to the thermometer originally used. These corrections have been kindly furnished by the Director of the Observatory from tables formed by a graphic method by Dr. HALM, formerly assistant.

	Strassburg Mean Time				Strassburg Mean Time		
	23^h	0^h	1^h		23^h	0^h	1^h
	°	°	°		°	°	°
December	+1.8 *C*	+1.9 *C*	+1.8 *C*	June	+2.0 *C*	+2.2 *C*	+2.0 *C*
January	+1.8	+1.9	+1.8	July	+2.2	+2.4	+2.2
February	+1.8	+1.9	+1.8	August	+2.2	+2.4	+2.2
March	+1.9	+1.9	+1.9	September	+2.2	+2.3	+2.1
April	+1.9	+2.0	+1.9	October	+2.1	+2.2	+1.9
May	+1.9	+2.1	+2.0	November	+2.0	+2.0	+1.9

Three times each day in the years 1892–3–4 comparisons were made with a sling thermometer. The differences, "Sling—External thermometer," are given in the following table, together with the number of observations, all observations being rejected when the sky was more than half clouded. These corrections were deduced by myself from the original records.

		7 A.M.		1 P.M		9 P.M.				7 A.M.		1 P.M.		9 P.M.	
		°		°		°				°		°		°	
Jan.	1–15	−0.1 *C*	(10)	+1.2 *C*	(18)	−0.1 *C*	(15)	July	1–15	−0.9 *C*	(20)	+2.9 *C*	(23)	−1.1 *C*	(24)
	16–31	+0.2	(10)	+1.7	(13)	−0.3	(15)		16–31	−0.3	(17)	+2.6	(19)	−1.0	(13)
Feb.	1–14	+0.3	(6)	+1.9	(6)	−0.2	(8)	Aug.	1–15	−0.6	(18)	+2.5	(19)	−0.8	(21)
	15–28	+0.1	(10)	+1.9	(10)	−0.1	(13)		16–31	−0.3	(22)	+3.2	(16)	−0.8	(18)
March	1–15	+0.1	(18)	+2.1	(17)	−0.4	(18)	Sept.	1–15	0.0	(9)	+3.4	(11)	−0.6	(12)
	16–31	0.0	(34)	+2.5	(34)	−0.8	(35)		16–30	−0.1	(9)	+3.6	(8)	−0.7	(5)
April	1–15	−0.2	(37)	+2.9	(40)	−0.8	(34)	Oct.	1–15	−0.1	(1)	+2.6	(3)	−0.6	(4)
	16–30	−0.2	(17)	+3.0	(15)	−0.9	(18)		16–31	0.0	(4)	+2.7	(10)	0.0	(9)
May	1–15	−0.3	(20)	+2.2	(21)	−1.0	(19)	Nov.	1–15	−0.4	(4)	+1.3	(8)	−0.3	(8)
	16–31	−0.5	(19)	+2.1	(19)	−1.0	(16)		16–30	. .		+1.0	(4)	0.0	(3)
June	1–15	−0.7	(18)	+2.1	(19)	−1.2	(15)	Dec.	1–15	+0.1	(8)	+1.7	(10)	−0.1	(7)
	16–30	−0.4	(24)	+2.7	(18)	−1.1	(22)		16–31	0.0	(13)	+1.5	(20)	−0.1	(19)

Through the kindness of Dr. HALM, now of the Edinburgh Observatory, I have been enabled to use a formula discovered by him in certain as yet unpublished temperature investigations.* By means of this formula the mean temperature for any hour of the day or night

* Since the above was written, Dr. HALM'S investigations have been published, under the title, "*Versuch einer theoretischen Darstellung des täglichen Ganges der Luft temperatur*"; *Nova Acta der Ksl. Leop. Carol. Deutschen Akademie der Naturforscher*, Bd. LXVII, Nr. 2.

at a given place can be quite accurately computed from regular observations made at convenient intervals. If ζ is the hour-angle of the sun, and τ the half-diurnal arc, then for day observations the formula is

$$t = t_a + 2\alpha \sin\frac{\zeta+\tau'}{2}\cos\frac{\zeta-\tau'}{2} - 2\beta \sin\frac{\zeta+\tau'}{2}\sin\frac{\zeta-\tau'}{2}$$

where t is the observed temperature at any given time, t_a is a constant for any given locality, and $\tau' = \tau - 0.5$ hours. If any of the observations have been made while the sun is below the horizon, the formula for such observations becomes

$$t = t_a + 2\alpha x \sin\frac{\tau+\tau'}{2}\cos\frac{\tau-\tau'}{2} - 2\beta x \sin\frac{\tau+\tau'}{2}\sin\frac{\tau-\tau'}{2}$$

where $x = \frac{b^{z+\tau-12}-1}{b^{2\tau-24}-1}$ z being the number of hours from midnight forward, and $\log b = 9.938$.

Assuming these formulae, if we have three series of observations made at any three given hours, day or night, we may find the constants t_a α and β, and so be enabled to compute the mean temperature for any hour desired.

In applying the formulae to the case in hand, it is evident that if T is the reading of one thermometer, and t of the other, the expression becomes for day observations,

$$T - t = (t_a' - t_a) + 2(\alpha' - \alpha)\sin\frac{\zeta+\tau'}{2}\cos\frac{\zeta-\tau'}{2} - 2(\beta' - \beta)\sin\frac{\zeta+\tau'}{2}\sin\frac{\zeta-\tau'}{2}$$

and a similar simple transformation may be made in the formula for night observations. Proceeding in this manner we arrive at the following series of values.

			Sling—Ext. Ther.						Sling—Ext. Ther.		
	$\alpha - \alpha'$	$\beta - \beta'$	$t_a - t_a'$	at noon	Obs.		$\alpha - \alpha'$	$\beta - \beta'$	$t_a - t_a'$	at noon	Obs.
			°	°					°	°	
Jan. 1–15	+0.20	+2.81	−0.11	+1.2	43	July 1–15	+1.34	+3.05	−2.74	+2.9	67
16–31	−0.35	+4.14	+0.21	+2.0	38	16–31	+0.78	+2.78	−1.87	+2.5	49
Feb. 1–14	−0.31	+3.71	+0.30	+2.1	20	Aug. 1–15	+0.98	+2.73	−1.92	+2.4	58
15–28	−0.23	+2.97	+0.28	+2.1	33	16–31	+0,85	+3.45	−1.60	+3.1	56
Mar. 1–15	−0.18	+3.13	+0.01	+2.3	53	Sept. 1–15	+0.53	+3.88	−0.94	+3.5	32
16–31	−0.09	+3.68	−0.44	+2.6	103	16–30	+0.34	+4.63	−0.76	+3.6	22
Apr. 1–15	+0.51	+3.48	−1.15	+2.9	111	Oct. 1–15	−0.17	+3.96	−0.10	+2.9	8
16–30	+0.65	+3.38	−1.51	+2.9	50	16–31	0.00	+3.97	+0.24	+2.9	23
May 1–15	+1.04	+1.73	−1.16	+2.0	60	Nov. 1–15	+0.30	+2.70	−0.40	+1.4	20
16–31	+0.74	+2.39	−1.82	+2.0	54	16–30	. .	. .	. .	. .	. .
June 1–15	+0.85	+2.46	−2.19	+2.0	52	Dec. 1–15	0.00	+4.18	+0.10	+1.8	25
16–30	+0.93	+2.74	−2.06	+2.5	64	16–31	+0.12	+3.71	0.00	+1.6	52

Plotting these corrections, having regard to their respective weights, the resulting curve gives the following values, which were adopted as a basis for the third hypothesis, and which reduce the readings of the original to the corresponding values of the sling thermometer.

Jan.	1–15	+1.4° C	May	1–15	+2.2° C	Sept.	1–15	+3.2° C
	16–31	+1.7		16–31	+2.0		16–30	+3.2
Feb.	1–14	+1.9	June	1–15	+2.2	Oct.	1–15	+2.8
	15–28	+2.1		16–30	+2.5		16–31	+2.4
Mar.	1–15	+2.4	July	1–15	+2.7	Nov.	1–15	+1.9
	16–31	+2.6		16–31	+2.5		16–30	+1.7
Apr.	1–15	+2.8	Aug.	1–15	+2.6	Dec.	1–15	+1.5
	16-30	+2.6		16–31	+2.9		16–31	+1.5

The Diameters.

The following table contains the monthly means of the correction to the *Berliner Jahrbuch* in the "Time of Diameter Passing the Meridian," and in Vertical Diameter with their probable error. All observations in "Time of Diameter Passing Meridian" have been rejected which depart more than $0^s.4$ from the general mean, and at the same time more than $0^s.3$ from the mean of the observer. The corresponding limits are $5''$ and $4''$ for the Vertical Diameter. A complete list of these rejected observations is:

Time of Diameter Passing Meridian.

1883 Jan. 31	+0.73	1883 April 26	−0.43	1885 Feb. 27	+0.58
1886 Dec. 26	−0.45	1887 Jan. 8	−0.42	1888 Nov. 17	+0.44

Vertical Diameter.

1883 Feb. 20	+5.40	1883 Mar. 3	+5.32	1883 Oct. 9	+4.18
1885 April 15	+4.80	1885 June 24	+4.34	1885 Dec. 3	−6.13
1886 July 2	−6.25	1886 Dec. 26	+4.76		

The numerals in ( ) refer to the number of observations.

	Schur		Wislicenus		Kaufman	
	Meridian Passage O—C	Vertical Diameter O—C	Meridian Passage O—C	Vertical Diameter O—C	Meridian Passage O—C	Vertical Diameter O—C
Jan.	+0.062 ± 0.021 (24)	−0.77 ± 0.31 (21)	−0.006 ± 0.028 (14)	−2.01 ± 0.31 (14)	−0.035 ± 0.015 (2)	−3.84 ± 0.61 (2)
Feb.	+0.051 ± 0.020 (29)	−0.08 ± 0.28 (26)	+0.032 ± 0.020 (10)	−1.00 ± 0.49 (11)	+0.190 ± 0.014 (5)	+0.13 ± 0.26 (5)
Mar.	+0.054 ± 0.016 (32)	−0.10 ± 0.22 (30)	−0.042 ± 0.011 (11)	−1.85 ± 0.51 (12)	+0.011 ± 0.025 (14)	+0.48 ± 0.33 (14)
Apr.	+0.071 ± 0.020 (12)	−0.55 ± 0.24 (12)	−0.035 ± 0.009 (19)	−1.64 ± 0.25 (24)	+0.056 ± 0.019 (14)	+0.12 ± 0.26 (15)
May	+0.061 ± 0.025 (14)	+0.92 ± 0.38 (13)	−0.049 ± 0.012 (16)	−1.76 ± 0.30 (17)	+0.061 ± 0.024 (8)	−0.71 ± 0.26 (8)
June	−0.039 ± 0.009 (36)	−1.06 ± 0.14 (39)	−0.077 ± 0.011 (21)	−2.32 ± 0.20 (23)	+0.068 ± 0.019 (6)	−1.11 ± 0.24 (9)
July	−0.018 ± 0.018 (25)	−0.76 ± 0.27 (27)	−0.066 ± 0.012 (32)	−1.72 ± 0.16 (33)	. . . . .	. . . . .
Aug.	−0.042 ± 0.012 (18)	−0.95 ± 0.22 (19)	−0.047 ± 0.014 (18)	−1.47 ± 0.26 (22)	+0.027 ± 0.014 (23)	−0.47 ± 0.15 (25)
Sept.	+0.035 ± 0.026 (17)	−0.14 ± 0.34 (18)	+0.025 ± 0.028 (10)	−0.86 ± 0.43 (10)	+0.024 ± 0.011 (30)	−0.63 ± 0.15 (32)
Oct.	+0.018 ± 0.038 (10)	−1.37 ± 0.38 (10)	−0.003 ± 0.033 (11)	−2.43 ± 0.40 (15)	−0.028 ± 0.035 (6)	−1.39 ± 0.62 (6)
Nov.	−0.056 ± 0.014 (7)	−1.41 ± 0.45 (8)	−0.041 ± 0.020 (8)	−1.83 ± 0.28 (10)	+0.140 ± 0.076 (2)	−0.35 (1)
Dec.	+0.081 ± 0.026 (16)	−1.40 ± 0.28 (20)	0.000 ± 0.041 (7)	−1.43 ± 0.50 (8)	. . . . .	. . . . .

If the times of passing the meridian are reduced to the corresponding horizontal diameter by the formula

$$D = 15\,T(1-\lambda)\cos\delta$$

and the horizontal and vertical diameters are reduced to the value at the mean distance of the sun, there results the following :

	Schur		Wislicenus		Kaufman	
	Horizontal	Vertical	Horizontal	Vertical	Horizontal	Vertical
	″	″	″	″	″	″
Jan.	+0.81	−0.75	−0.09	−1.97	−0.48	−3.76
Feb.	+0.74	−0.08	+0.46	−0.99	+2.72	+0.13
Mar.	+0.79	−0.10	−0.62	−1.83	+0.15	+0.48
Apr.	+1.05	−0.55	−0.52	−1.64	+0.89	+0.12
May	+0.83	+0.93	−0.70	−1.77	+0.89	−0.72
June	−0.62	−1.08	−1.07	−2.35	+0.95	−1.12
July	−0.26	−0.78	−0.94	−1.76	. .	. .
Aug.	−0.62	−0.96	−0.69	−1.49	+0.41	−0.47
Sept.	+0.53	−0.14	+0.38	−0.87	+0.37	−0.64
Oct.	+0.27	−1.37	−0.04	−2.43	−0.41	−1.39
Nov.	−0.79	−1.40	−0.58	−1.84	+1.98	−0.34
Dec.	+1.11	−1.39	0.00	−1.41	. .	. .

Uniting these values we have as the difference between the observations and *Jahrbuch* diameter of the sun when weights are assigned according to the number of observations,

	Schur	Wislicenus	Kaufman
Horizontal	+0.″31 ±0.″13 (240)	−0.″48 ±0.″09 (177)	+0.″57 ±0.″13 (110)
Vertical	−0.60 ±0.12 (243)	−1.76 ±0.08 (199)	−0.47 ±0.15 (117)

and a simple Arithmetical Mean without regard to weights is

	Schur	Wislicenus	Kaufman
Horizontal	+0.″32 ±0.″14	−0.″37 ±0.″09	+0.″75 ±0.″21
Vertical	−0.64 ±0.14	−1.70 ±0.09	−0.77 ±0.26

If the observations of Kaufman in Horizontal Diameter for February, and in Vertical for January, are rejected, his values are

	Horizontal	Vertical
With weights	+0.″47 ±0.″10	−0.″41 ±0.″10
Without weights	+0.53 ±0.17	−0.44 ±0.14

Combining these results obtained for the different observers, and using the first value of Kaufman, we have

	With Weights	Without Weights
Horizontal	+0.″10 ±0.″20 (527)	+0.″23 ±0.″22
Vertical	−0.99 ±0.28 (559)	−1.04 ±0.22

while if the second value of Kaufman is used these become

	With Weights	Without Weights
Horizontal	$+0''.07 \pm 0''.20$	$+0''.16 \pm 0''.18$
Vertical	-0.98 ± 0.28	-0.93 ± 0.26

According to the later researches of Professor AUWERS the value of the diameter used in the *Jahrbuch* during the period of these observations was $3''.2$ too large. Adhering to the second value for KAUFMAN as the more probable, the difference O—C from all the observations is

With weights $-0''.47$ Without weights $-0''.38$

either of which have the same sign for the correction as Professor AUWERS, and show that the observers in their use of the Meridian Circle estimated the diameter of the sun about $2''.8$ too large.

For the purpose of weighting the equations in the subsequent work, the observations have been divided according to the season of the year, and both the probable error of a single observation, as well as the probable error of the mean for each of the periods, has been computed with the following result. The numerals in parentheses denote the probable error of the mean and the number of observations.

HORIZONTAL DIAMETER.

	SCHUR		WISLICENUS		KAUFMAN	
Dec., Jan., Feb.,	$+0''.85 \pm 1''.46 (\pm 0''.18)$	(69)	$+0''.11 \pm 1''.45 (\pm 0''.26)$	(31)	$+1''.83 \pm 1''.05 (\pm 0''.43)$	(7)
March, April, May,	$+0.86 \pm 1.26 (\pm 0.17)$	(58)	$-0.61 \pm 0.85 (\pm 0.13)$	(46)	$+0.60 \pm 1.15 (\pm 0.20)$	(36)
June, July, Aug.,	$-0.51 \pm 0.90 (\pm 0.10)$	(79)	$-0.91 \pm 0.86 (\pm 0.10)$	(71)	$+0.55 \pm 0.90 (\pm 0.17)$	(29)
Sept., Oct., Nov.,	$+0.19 \pm 1.48 (\pm 0.26)$	(34)	$-0.04 \pm 1.26 (\pm 0.24)$	(29)	$+0.39 \pm 1.01 (\pm 0.16)$	(38)

VERTICAL DIAMETER.

Dec., Jan., Feb.,	$-0''.68 \pm 1''.36 (\pm 0''.17)$	(67)	$-1''.51 \pm 1''.37 (\pm 0''.24)$	(33)	$-0''.98 \pm 1''.31 (\pm 0''.53)$	(7)
March, April, May,	$+0.05 \pm 1.18 (\pm 0.16)$	(55)	$-1.73 \pm 1.28 (\pm 0.18)$	(53)	$+0.08 \pm 1.05 (\pm 0.18)$	(37)
June, July, Aug.,	$-0.96 \pm 1.09 (\pm 0.12)$	(85)	$-1.86 \pm 1.02 (\pm 0.11)$	(78)	$-0.64 \pm 0.74 (\pm 0.13)$	(34)
Sept., Oct., Nov.,	$-0.76 \pm 1.38 (\pm 0.23)$	(36)	$-1.81 \pm 1.36 (\pm 0.24)$	(35)	$-0.74 \pm 0.94 (\pm 0.16)$	(39)

In making use of the observed "Time of Diameter Passing the Meridian," and Vertical Diameters for the purpose of reducing the observations when the sun has been observed on a single limb, it becomes of interest to note whether there is any systematic difference depending on the season of the year. Forming equations for the monthly means of the form

$$x + y \sin 2\pi t + z \cos 2\pi t = h$$

where t represents the time from Jan. 1 expressed as a fraction of a year, and h is the quantity O—C, weighting such equations according to the probable errors of the Quarterly Means, *i.e.*, giving the same weight to all equations of a given observer in a given season of the year, and solving by Least Squares there results :

	Horizontal Diameter.			Vertical Diameter.		
	Schur	Wislicenus	Kaufman	Schur	Wislicenus	Kaufman
x	$+0''.24 \pm 0''.10$	$-0''.37 \pm 0''.07$	$+0''.74 \pm 0''.20$	$-0''.71 \pm 0''.13$	$-1''.71 \pm 0''.09$	$-0''.47 \pm 0''.18$
y	$+0.54 \pm 0.15$	-0.11 ± 0.09	$+0.14 \pm 0.23$	$+0.57 \pm 0.19$	-0.09 ± 0.14	$+0.32 \pm 0.20$
z	$+0.57 \pm 0.13$	$+0.63 \pm 0.10$	$+0.23 \pm 0.37$	-0.12 ± 0.16	$+0.16 \pm 0.13$	$+0.32 \pm 0.33$

If we unite the variable portion of these expressions there results :

	Horizontal	Vertical
Schur	$+0''.78 \sin 2\pi(t-0.871)$	$+0''.58 \sin 2\pi(t-0.032)$
Wislicenus	$+0.64 \sin 2\pi(t-0.722)$	$+0.18 \sin 2\pi(t-0.667)$
Kaufman	$+0.27 \sin 2\pi(t-0.837)$	$+0.45 \sin 2\pi(t-0.875)$

With the single exception of the Vertical Diameter of Schur these expressions have a maximum in the coldest quarter of the year, and the mean value is approximately the first of February. This seems to render it quite possible that a relation exists between the observed value of the diameter and the season of the year, and which is possibly to be referred as in many other series of observations, to the unequal lengthening of the focal distance of the lense and of the telescope tube. It must, however, be said that for a more exact discussion of the question the error of the ephemeris must be taken into consideration.

It will be observed that many observations have the letters R and S with a numeral attached. The former refers to the state of the atmosphere, and the latter to the quality of the image. The numerical scale is from 1 to 5, and the increase in the numeral is coincident with increasing disturbance of the atmosphere and diffuseness of the image. A little study shows that Kaufman's 3, 4 and 5 correspond to 2, 3 and 4 of the other two. In bringing these together in groups large enough to eliminate to some extent the effect of the accidental errors, it has been necessary to unite the scattered observations. The column headed 2 includes the observations marked 1, and 4 contains 5 also. The observations of Schur in 1883 have been distributed on the principle that "indistinct" was equivalent to 3, and "very indistinct" to 4. We have the following as corrections to the horizontal and vertical diameters, when reduced to the mean distance of the sun, the parentheses as before containing the number of observations.

Horizontal.

	$R = 2$	$R = 3$	$R = 4$
Schur	$-0''.34 \pm 0''.18$ (22)	$+0''.59 \pm 0''.15$ (62)	$+1''.59 \pm 0''.29$ (36)
Wislicenus	. . . .	-0.65 ± 0.27 (18)	-0.43 ± 0.18 (48)
Kaufman	$+0.12 \pm 0.27$ (18)	$+0.56 \pm 0.18$ (25)	$+1.29 \pm 0.11$ (20)
	$S = 2$	$S = 3$	$S = 4$
Schur	$-0''.43 \pm 0''.18$ (23)	$+0''.58 \pm 0''.14$ (57)	$+1''.49 \pm 0''.32$ (33)
Wislicenus	. . . .	-0.50 ± 0.21 (26)	-0.48 ± 0.20 (40)
Kaufman	$+0.09 \pm 0.24$ (16)	$+0.04 \pm 0.21$ (20)	$+1.57 \pm 0.20$ (27)

VERTICAL.

	$R = 2$	$R = 3$	$R = 4$
Schur	$-1''.84 \pm 0''.21$ (23)	$-0''.50 \pm 0''.16$ (60)	$+0''.86 \pm 0''.25$ (38)
Wislicenus	. . . .	$-2''.17 \pm 0''.16$ (22)	$-1''.44 \pm 0''.20$ (51)
Kaufman	$-1''.11 \pm 0''.19$ (21)	$-0''.12 \pm 0''.18$ (25)	$+0''.50 \pm 0''.18$ (22)
	$S = 2$	$S = 3$	$S = 4$
Schur	$-1''.38 \pm 0''.15$ (24)	$-0''.67 \pm 0''.17$ (55)	$+0''.52 \pm 0''.28$ (35)
Wislicenus	. . . .	$-1''.95 \pm 0''.13$ (30)	$-1''.46 \pm 0''.24$ (46)
Kaufman	$-1''.00 \pm 0''.20$ (18)	$-0''.46 \pm 0''.20$ (21)	$+0''.44 \pm 0''.16$ (29)

The above simple combinations have been made, although a large number of others are possible. The increase in the apparent size of the sun's diameter as the condition of atmosphere and image grow worse is quite marked, and scarcely less so is the fact that this affects both the vertical and horizontal diameters. The largest difference is in the case of SCHUR, and is nearly two seconds of arc in horizontal diameter, and over this amount in vertical. Such differences have been also observed by WAGNER in the Pulkowa observations, and by AUWERS in those of Keating at Oxford.

THE CORRECTION TO THE EQUINOX AND OBLIQUITY OF THE ECLIPTIC.

If δ' represents a declination computed from an observed right-ascension of the sun, and δ the corresponding observed declination, we have the equation

$$\delta' + d\delta' = \delta + d\delta$$

If we operate solely upon the residuals obtained by a comparison of the observations with a standard ephemeris, the small correction for the sun's latitude disappears from the expression $d\delta' - d\delta$ and δ' may be considered as a function of α, the right-ascension, and ϵ, the obliquity of the ecliptic, of the form

$$\delta' = \text{arc tg}\,(\sin\alpha\ \text{tg}\,\epsilon)$$

From this

$$d\delta' = \frac{\cos\alpha\ \cos\epsilon\ \sin\epsilon\ d\alpha}{1 - \cos^2\alpha\ \sin^2\epsilon} + \frac{\sin\alpha\ d\epsilon}{1 - \cos^2\alpha\ \sin^2\epsilon} = Ad\alpha + Bd\epsilon$$

$d\alpha$ here not merely represents the common correction to the right-ascensions of the stars made use of in the solar observations, but also the difference in the observer's perception of the transit of a star and of the sun. Aside from any small error in the solar parallax, which may be neglected, and the correction for flexure of the instrument that has already been added to the observations, $d\delta$ is to be considered as composed of two parts. The first of these may be represented by $d\varphi$, and is to be thought of as consisting of the error in the mean

latitude, and the personal equation in measuring zenith distances. The second part is any correction that may be needed in the refraction constant so that

$$d\delta = d\varphi + d_\rho \operatorname{tg} z = d\varphi + Cd\rho$$

and therefore the equation becomes

$$\delta' + Ad\alpha + Bd\epsilon = \delta + d\varphi + Cd\rho$$

If $\delta - \delta' = N$ then

$$Ad\alpha + Bd\epsilon - d\varphi = N + Cd\rho$$

The coefficients of these equations are given in Appendix I with the value of N for each of the refraction hypotheses. But before proceeding to their solution, it becomes necessary to explain the manner in which the weights are determined.

Weights of Equations of Condition for $d\alpha$, $d\epsilon$ and $d\varphi$.

If p represents the probable error of an observed right-ascension, and q the probable error of an observed declination, then the probable error of a computed declination is

$$p \operatorname{tg} \epsilon \cos \alpha \cos^2 \delta$$

and the probable error of $\delta - \delta'$ is

$$\pi = \sqrt{(p \operatorname{tg} \epsilon \cos \alpha \cos^2 \delta)^2 + q^2}$$

If D and D' are the probable errors of the horizontal and vertical diameters respectively, then $\frac{D}{\sqrt{2}}$ and $\frac{D'}{\sqrt{2}}$ are the probable errors of a single limb, and $\frac{D}{2}$ and $\frac{D'}{2}$ those of the center if the probable errors for both limbs are supposed to be the same. Then if t is the probable error of the correction of the standard clock, and n that of a nadir determination,

$$p = \sqrt{\frac{D^2}{4} + t^2} \qquad \text{and} \qquad q = \sqrt{\frac{D'^2}{4} + n^2}$$

while π takes the form

$$\pi = \sqrt{\left(\frac{D^2}{4} + t^2\right) \operatorname{tg}^2 \epsilon \cos^2 \alpha \cos^4 \delta + \frac{D'^2}{4} + n^2}$$

The values of D and D' which have been used are those deduced from the quarterly mean, and have been given previously on page 10. In their determination no account has been taken of the number of threads upon which the observation has been made. The value of t is taken for each day from the records of the Observatory, as it depends upon the number of clock stars observed, and the number of standard clocks made use of in forming the clock correction on that particular day. The value of the probable error of a nadir estimation is for

Schur $\pm 0''.14$ Wislicenus $\pm 0''.14$ Kaufman $\pm 0''.10$

The unit of weight is different for each observer, and is the weight corresponding to the probable error of an observation made at the vernal equinox when t depended on the observation of two clock stars, and the use of two standard clocks, and has the value

For Schur $\pm 0''.68$ For Wislicenus $\pm 0''.69$ For Kaufman $\pm 0''.60$

Normal Equations for $d\alpha$, $d\epsilon$ and $d\varphi$.

Uniting the equations of condition by the method of least-squares, there results the following systems of normal equations:

Schur.

			Hypothesis I	Hypothesis II	Hypothesis III	
$+19.25\,d\alpha$	$-\ 8.05\,d\epsilon$	$-\ 9.22\,d\varphi$	$=$	$-\ 11''.93$	$-\ 5''.57$	$-\ 4''.36$	$+\ 17.96\,d\rho$
$-\ 8.05\,d\alpha$	$+157.06\,d\epsilon$	$-\ 62.94\,d\varphi$	$=$	$-\ 86.47$	-118.30	-107.84	$-\ 80.36\,d\rho$
$-\ 9.22\,d\alpha$	$-\ 62.94\,d\epsilon$	$-259.46\,d\varphi$	$=$	$+359.55$	$+234.66$	$+230.40$	$-304.04\,d\rho$

Wislicenus.

$+16.23\,d\alpha$	$-\ 7.75\,d\epsilon$	$+\ 4.92\,d\varphi$	$=$	$+\ 24''.94$	$+\ 24''.26$	$+\ 24''.66$	$-\ 0.13\,d\rho$
$-\ 7.75\,d\alpha$	$+154.06\,d\epsilon$	$-\ 99.74\,d\varphi$	$=$	$-\ 44.09$	$-\ 48.52$	$-\ 38.96$	$-\ 20.44\,d\rho$
$+\ 4.92\,d\alpha$	$-\ 99.74\,d\epsilon$	$+238.96\,d\varphi$	$=$	$+156.75$	$+\ 59.47$	$+\ 53.00$	$-238.88\,d\rho$

Kaufman.

$+20.25\,d\alpha$	$-\ 5.47\,d\epsilon$	$+\ 17.57\,d\varphi$	$=$	$+\ 44''.56$	$+\ 38''.72$	$+\ 34''.87$	$-\ 15.75\,d\rho$
$-\ 5.47\,d\alpha$	$+\ 46.07\,d\epsilon$	$-\ 53.64\,d\varphi$	$=$	$-\ 44.22$	$-\ 33.16$	$-\ 29.80$	$+\ 26.29\,d\rho$
$+17.57\,d\alpha$	$-\ 53.64\,d\epsilon$	$+153.93\,d\varphi$	$=$	$+160.15$	$+104.48$	$+\ 86.48$	$-141.64\,d\rho$

From these equations are deduced the following values of the unknown quantities.

Schur.

			Hypothesis I	Hypothesis II	Hypothesis III	Weight
$d\alpha$	$=$	$-0.22\,d\rho$	$+0''.052$	$-0''.093$	$+0''.003$	18.2
$d\epsilon$	$=$	$-1.10\,d\rho$	$+0.009$	-0.440	-0.366	136.3
$d\varphi$	$=$	$-1.45\,d\rho$	$+1.390$	$+0.795$	$+0.799$	226.0

Wislicenus.

$d\alpha$	$=$	$-0.08\,d\rho$	$+1''.441$	$+1''.377$	$+1''.433$	15.8
$d\epsilon$	$=$	$-1.08\,d\rho$	$+0.262$	-0.141	-0.077	110.4
$d\varphi$	$=$	$-1.45\,d\rho$	$+0.736$	$+0.162$	$+0.160$	174.4

Kaufman.

$d\alpha$	$=$	$+0.05\,d\rho$	$+1''.427$	$+1''.466$	$+1''.371$	18.2
$d\epsilon$	$=$	$-0.87\,d\rho$	$+0.389$	$+0.086$	-0.020	27.3
$d\varphi$	$=$	$-1.22\,d\rho$	$+1.013$	$+0.541$	$+0.398$	85.1

A glance at these results reveals at once the great influence of an erroneous reading of the thermometer, since even the comparatively small difference between the aspiration and

sling thermometers produces a change of a tenth of a second in the value of the obliquity in the case of KAUFMAN and the difference between the first and other hypotheses is very marked for all. The results of the second hypothesis have been adhered to in the subsequent computations, as the first is known to be wrong from other considerations and the thermometer observations at the basis of the second are of greater worth than in the case of the third. While only a comparatively short series of star observations was available for the purpose, Professor BECKER has kindly placed at my disposal the results of a provisional discussion, which indicate that the correction to the Refractions of BESSEL (Tab. Reg.) used in reducing the declinations, may be regarded as zero. Under these conditions we have as probable errors

	Probable error of unit of wt.	$d\alpha$	$d\varepsilon$	$d\varphi$
	″	″	″	″
Schur	±0.77	±0.180	±0.066	±0.051
Wislicenus	±0.80	±0.204	±0.077	±0.061
Kaufman	±0.92	±0.216	±0.167	±0.100

The discrepancies between the values of the probable error of the unit of weight as given by the formula and those deduced from the residuals after substituting $d\alpha$, $d\epsilon$ and $d\varphi$ in the equations of condition, show that too great accuracy was originally ascribed to the observations. Owing to a misunderstanding, the equations were originally solved, using a system of weights where the probable error of a nadir estimation was assumed to be four times the true amount. As these results may serve to illustrate a few facts not otherwise shown in the solution, they are appended. Confining ourselves to the second hypothesis, the probable errors corresponding to the unit of weight as derived from the formula are:

SCHUR	WISLICENUS	KAUFMAN
±0″.85	±0″.90	±0″.68

and the values of the unknown quantities are

	SCHUR		WISLICENUS		KAUFMAN	
	″	″	″	″	″	″
$d\alpha$	+0.006	±0.179	+1.427	±0.201	+1.429	±0.200
$d\epsilon$	−0.419	±0.066	−0.144	±0.077	+0.084	±0.170
$d\varphi$	+0.820	±0.051	+0.166	±0.061	+0.531	±0.087

When these values are substituted the probable errors of the units of weight as derived from the residuals are

±0″.80	±0″.81	±0″.80

The comparison of these results with the preceding shows no great changes in the values of the unknown quantities, but it is evident that the weight formula would better express the real state of the observations if a constant c^2 were added to π^2, the square of the probable error of an equation as given by the formula.

While the values of $d\alpha$ and $d\varphi$ must of necessity be different for each of the three observers, because they each contain the personal equation of the observer, it is evident that aside from the small difference arising from the centennial variation, the true value of $d\epsilon$ must be the same for all. Uniting the values given above we have as the correction of the obliquity of the ecliptic

$$d\epsilon = -0''.280 \pm 0''.086$$

We may find, however, the value of $d\epsilon$ that is common to the entire series of observations in another manner and yet preserve the distinction of the different values of $d\alpha$ and $d\varphi$ for the different observers. It is first necessary to have a common system of weights. That of SCHUR has been chosen and the factors by which the others are to be multiplied to reduce to this system are for

WISLICENUS 0.97 KAUFMAN 1.28

The normal equations then are

$$\begin{array}{rrrrrrrrrrrrrrrrrrrrr}
+19.25\,d\alpha' & + & 0\,d\alpha'' & + & 0\,d\alpha''' & - & 8.05\,d\epsilon & - & 9.22\,d\varphi' & + & 0\,d\varphi'' & + & 0\,d\varphi''' & = & -5''.57 \\
0\,d\alpha' & + & 15.74\,d\alpha'' & + & 0\,d\alpha''' & - & 7.52\,d\epsilon & + & 0\,d\varphi' & + & 4.77\,d\varphi'' & + & 0\,d\varphi''' & = & +23.53 \\
0\,d\alpha' & + & 0\,d\alpha'' & + & 25.92\,d\alpha''' & - & 7.00\,d\epsilon & + & 0\,d\varphi' & + & 0\,d\varphi'' & + & 22.49\,d\varphi''' & = & +49.56 \\
-8.05\,d\alpha' & - & 7.52\,d\alpha'' & - & 7.00\,d\alpha''' & + & 365.47\,d\epsilon & - & 62.94\,d\varphi' & - & 96.75\,d\varphi'' & - & 68.66\,d\varphi''' & = & -207.80 \\
-9.22\,d\alpha' & + & 0\,d\alpha'' & + & 0\,d\alpha''' & - & 62.94\,d\epsilon & + & 259.46\,d\varphi' & + & 0\,d\varphi'' & + & 0\,d\varphi''' & = & +234.66 \\
0\,d\alpha' & + & 4.77\,d\alpha'' & + & 0\,d\alpha''' & - & 96.75\,d\epsilon & + & 0\,d\varphi' & + & 231.79\,d\varphi'' & + & 0\,d\varphi''' & = & +57.69 \\
0\,d\alpha' & + & 0\,d\alpha'' & + & 22.49\,d\alpha''' & - & 68.66\,d\epsilon & + & 0\,d\varphi' & + & 0\,d\varphi'' & + & 197.03\,d\varphi''' & = & +133.73
\end{array}$$

The solution of these equations results in the following values of the different unknown quantities and their probable errors, the probable error of the unit of weight as found from the residuals being $\pm 0''.85$.

	$d\alpha$	wt.	$d\varphi$	wt.
Schur	$+0''.006 \pm 0''.197$	18.6	$+0''.841 \pm 0''.055$	240.0
Wislicenus	$+1''.334 \pm 0''.216$	15.5	$+0''.113 \pm 0''.060$	202.4
Kaufman	$+1''.478 \pm 0''.176$	23.3	$+0''.420 \pm 0''.066$	164.4

$d\epsilon$ $-0''.259 \pm 0''.051$ wt. 278.4

Could we divide the two components of $d\alpha$, we could at once find the value of the correction of the equinox that best represents the entire series of observations. The fact that the personal equation of an observer is different when he has observed a clock-star and then the sun, has however interposed an obstacle that has heretofore never been successfully overcome. In an essay* in which he has attempted to determine his absolute personal equation for both sun and star observations by means of an apparatus of his own construction, Professor WISLICENUS has deduced his difference in personal equation for the two classes of observations, with the result that for a disc of $16'\ 2''$ diameter his correction in the sense "Disc—Star" is $-0^s.059$. It is only fair to say that he seems to attach a comparatively

* *Untersuchungen über den Absoluten Persönlichen Fehler bei Durchgangs Beobachtungen;* 1888.

small weight to this result on account of a lack of sufficient observations. It is also to be remembered that if it is by no means safe to assume that the same personal equation attaches itself to the transit of a natural and an artificial star, these uncertainties are multiplied many fold in the case of solar observations. A disc may represent the apparent size of the sun. It can not, however, be subject to those peculiarities that arise from atmospheric conditions, and are such a prolific source of systematic error in this class of observations. $d\alpha$ as given by his solar observations is determined by the equation

$$d\alpha = \Delta T - \Delta t + \gamma$$

where ΔT is the correction to be added to the time of transit of the sun on account of personal equation, Δt is the corresponding correction for the star observations, and γ represents the common correction to the right-ascensions of the fundamental star system. Hence we have "Disc — Star" $= d\alpha - \gamma$. Comparing his value $-0^s.059$ with a mean of those found from his solar observations $+0^s.090$, it is apparent that the difference can not be explained by assuming any reasonable hypothesis as to γ. On the other hand, his determination for a 11′ 27″ disc is in very close agreement.

From the tables given on page 48 of the same essay we readily deduce that for declination —23° 25′ the 16′ 2″ disc gives the difference "Disc — Star" as $-0^s.036$, while for declination +23° 25′ the value is $-0^s.070$. Correspondingly the 11′ 27″ disc gives $+0^s.082$ and $+0^s.141$ for the two positions. While we have not sufficient material to deal with this question directly, we may divide the observations in two groups, one with positive and the other with negative declinations. From 130 observations above the equator, using the second refraction hypothesis

$$d\alpha = +0''.836 + 0.242\, d\epsilon \qquad d\varphi = +0''.296 + 0.787\, d\epsilon$$

and from 72 observations made when the sun was below the equator

$$d\alpha = +2''.410 + 0.078\, d\epsilon \qquad d\varphi = +0''.070 - 0.647\, d\epsilon$$

Using the value of $d\epsilon$ derived from the entire series of his observations —0″.141, we have

Below the equator $d\alpha = +0^s.160$ Above the equator $d\alpha = +0^s.053$

The absolute values of $d\alpha$ here agree more closely with those of the 11′ 27″ disc, but the difference between them is quite similar to that for the larger.

Failing a method to divide these results we can only unite them as they stand. From the union of such observations by a large number of observers, the systematic errors of each may be regarded in the same light as accidental errors with respect to the final mean. While the differences here are great and the number of observers is small, no other course is open.

Uniting the results with weights inversely proportional to the squares of the probable errors we have as the most probable value of $d\alpha$

From first solution $+0^s.054 \pm 0^s.019$ From second solution $+0^s.064 \pm 0^s.022$

or uniting without regard to probable error or number of observations there results

From first solution $+0^s.061 \pm 0^s.023$ From second solution $+0^s.063 \pm 0^s.021$

The result of the preliminary discussion of the latitude of the Strassburg Observatory, kindly placed at my service by the Director, shows a correction of $+0''.29$ as the most probable for the mean latitude used in the reduction of the present series of observations. Since $d\varphi = d\varphi_0 - dz$, where $d\varphi_0$ is the correction of the mean latitude, and dz the personal equation in measuring zenith distances, we may very easily arrive at a value of the latter quantity. For our two solutions we have

	dz 1st Solution	dz 2d Solution
	$''$	$''$
Schur	-0.51	-0.55
Wislicenus	$+0.13$	$+0.18$
Kaufman	-0.25	-0.13

While it can hardly be expected that dz will be the same for star observations as for those of the sun, yet the values as furnished by the Observatory are given for comparison. From direct star observations, in which an observation made with the observer facing north is compared with one made facing south, there results

Schur $-0''.80$ Wislicenus $+0''.15$ Kaufman $-0''.02$

while from a union of these values with observations of *Polaris* there results

Wislicenus $+0''.07$ Kaufman $-0''.04$

The correspondence in the case of WISLICENUS is quite marked.

THE LUNAR EQUATION.

The so-called Lunar Equation, or the variation of the sun's position arising from the revolution of the earth around the common center of gravity of itself and the moon, aside from its necessity in the construction of an accurate solar ephemeris, is of interest in that it affords an independent method of determining the solar parallax if the mass of the moon is given or if the solar parallax is assumed, it leads to a determination of the constant of Nutation (LAVES, *A.N.* 3156). The principal determinations from observation have been those of LEVERRIER (*Annales de l'Observatoire de Paris*, Tome 4); NEWCOMB (*Investigation of the Distance of the Sun and the Elements which depend upon it*); GILL, from the heliometer observations of Victoria (*Monthly Notices*, Vol. LIV); DEICHMÜLLER, from the solar observations of

ARGELANDER (*Vierteljahrschrift der Astronomischen Gesellschaft*, XXVI); and finally the recently published results of Prof. NEWCOMB (*Elements of the Four Inner Planets and the Fundamental Constants of Astronomy*). A peculiarity of this latter determination is contained in the following extract:

"I had intended to use all the observations of the sun up to the present time. I found, however, that those made after 1864 gave by comparison with the published ephemerides inadmissible positive corrections to the coefficient. This circumstance gives rise to a strong suspicion that in the process of interpolating the right-ascensions of the sun at least some years after 1864, the inequality in question was rounded off to the amount of several hundredths of a second. These results were therefore omitted."

As the Strassburg observations are in the period spoken of, it has seemed best to re-compute not only the correction to the Lunar Equation, but in order to use all the observations, to also introduce terms in the equations to represent the correction to the Mean Longitude, Eccentricity and Longitude of the Perigee.

THE CORRECTION TO THE COEFFICENT OF THE LUNAR EQUATION, MEAN LONGITUDE, LONGITUDE OF THE PERIGEE AND ECCENTRICITY, FROM THE RIGHT-ASCENSIONS.

As previously stated, the *Berliner Jahrbuch* from 1883 to 1887 inclusive neglects certain terms which must be added to its right-ascensions and declinations to make them strictly conform to the theory of LEVERRIER. These terms are in longitude

$$-0''.204 \sin 2\mathbb{C} + 0''.068 \sin(\mathbb{C} - \Gamma') - 0''.021 \sin(\odot + \Gamma) + 0''.127 \sin(\odot - \Gamma)$$

and in obliquity of the ecliptic

$$+0''.089 \cos 2\mathbb{C}$$

$\odot$, $\mathbb{C}$, Γ and Γ' having here the usual signification. Applying these corrections, adding the values of $d\alpha$ as derived from the second refraction hypothesis to the residuals O—C of the respective observers, and representing the result by $\Delta\alpha'$, the equation of condition between the correction of the longitude λ, the obliquity of the ecliptic ϵ, and the right-ascension α, would be

$$\Delta\alpha' = \cos\epsilon \sec^2\delta \Delta\lambda - \tfrac{1}{2} \operatorname{tg}\epsilon \sin 2\alpha \Delta\epsilon$$

We may here consider $\Delta\epsilon$ as a known quantity. The value used in the reduction of the observations is —0″.13, or that given by Professor NEWCOMB* as derived from solar obser-

* *Astronomical Constants*, p. 41.

vations, if the centennial variation is applied, and his tabular value reduced to the middle of our observation period. If $(1+x)P'$ represent the corrected value of the Lunar Equation, P' being defined by the equation

$$P' = \frac{m'}{m+m'} \cdot \frac{\pi}{\pi'} \frac{\cos\beta}{\sin 1''} \sin(\mathbb{C}-\odot)$$

Δl, Δe, $\Delta\pi$ the corrections to the mean longitude, eccentricity and longitude of the perigee respectively, and $(1+\mu)V$ the perturbation due to *Venus* when corrected for any change in its mass, then

$$\Delta\lambda = P'x + \frac{d\lambda}{dl}\Delta l + \frac{d\lambda}{de}\Delta e + \frac{d\lambda}{ed\pi} e\Delta\pi + \mu V$$

But if M represents the mean anomaly of the sun

$$\frac{d\lambda}{dl} = 1 + 2e\cos M \qquad \frac{d\lambda}{de} = 2\sin M \qquad \frac{d\lambda}{ed\pi} = -2\cos M$$

and if

$$\Delta\alpha = \Delta\alpha' + \tfrac{1}{2}\operatorname{tg}\epsilon \sin 2\alpha\Delta\epsilon \qquad P = \frac{P'\cos\epsilon}{\cos\delta}$$

$$E = \frac{1+2e\cos M\cos\epsilon}{\cos\delta} \qquad F = \frac{2\sin M\cos\epsilon}{\cos\delta}$$

$$G = \frac{-2\cos M\cos\epsilon}{\cos\delta} \qquad H = \frac{V\cos\epsilon}{\cos\delta}$$

the equation takes the form

$$Px + E\Delta l + F\Delta e + Ge\Delta\pi = \Delta\alpha'\cos\delta - H\mu$$

The coefficients of the equations of condition formed in this manner are given in Appendix II. The Lunar Equation is computed for each day, and the *Venus* perturbation for every tenth day, and the value for the day of observation found by interpolation. The principle upon which the weights have been computed is the same as previously explained, with the single exception that the unit of weight is an observation with the probable error $\pm 0''.6745$. From these equations are derived by the Method of Least Squares the following Normal Equations :

$$\begin{aligned}
&+12905.13x + 106.00\Delta l - 374.09\Delta e - 121.23e\Delta\pi = -530''.17 + 239''.7\mu\\
&+\ 106.00x + 595.12\Delta l + 100.12\Delta e + 416.14e\Delta\pi = -597.90 - 1115.1\mu\\
&-\ 374.09x + 100.12\Delta l + 1045.75\Delta e - 89.70e\Delta\pi = +\ 64.14 + 1084.8\mu\\
&-\ 121.23x + 416.14\Delta l - 89.70\Delta e + 1363.04e\Delta\pi = -295.53 - 1906.2\mu
\end{aligned}$$

Solving these equations, the following values of the different unknown quantities result :

x	$= -0.02563 + 0.054\mu$	Weight 12677
Δl	$= -1''.123 - 1''.41\mu$	450
Δe	$= +0.171 + 1.12\mu$	994
$e\Delta\pi$	$= +0.135 - 0.89\mu$	1043

If the correction to the mass of *Venus* is taken at —0.012, the value given by Professor NEWCOMB in "*Astronomical Constants*," and the probable errors computed there results:

$$x = -0.02628 \quad \pm 0.00621 \qquad \Delta l = -1''.106 \quad \pm 0''.033$$
$$\Delta e = +0''.158 \quad \pm 0''.022 \qquad e\Delta\pi = +0''.146 \quad \pm 0''.022$$

while the probable error of the unit of weight as obtained from the residuals is $\pm 0''.6995$. When the value of x is expressed in seconds of arc the correction to the coefficient of the Lunar Equation becomes $-0''.171 \pm 0''.040$.

In order to use the values of $d\alpha$ derived from the second solution we have only to add to the $\Delta\alpha \cos\delta$ of the different observers $+0''.10 \cos\delta$, $-0''.04 \cos\delta$ and $+0''.01 \cos\delta$ respectively. The corresponding values of the unknown quantities, after adding the correction for the change in the mass of *Venus*, are found to be

$$x = -0.02676 \qquad \Delta l = -1''.075$$
$$\Delta e = +0''.159 \qquad e\Delta\pi = +0''.138$$

and the correction to the Lunar Equation is $-0''.174$.

THE CORRECTION TO THE MEAN LONGITUDE, THE LONGITUDE OF THE PERIGEE AND THE ECCENTRICITY, FROM THE DECLINATIONS.

Representing by $\Delta\delta'$ the value of a residual O—C in declination, when the *Jahrbuch* has been corrected in accordance with the last section, the equation of condition between the correction of the longitude λ, the obliquity of the ecliptic ϵ, and the declination of the Sun δ, would be

$$\Delta\delta = \operatorname{tg}\delta \cot\epsilon \, \Delta\epsilon + \sin\epsilon \cos\alpha \, \Delta\lambda$$

where as before $\Delta\epsilon$ is to be treated as a known quantity.

If

$$(1+2e\cos M)\sin\epsilon\cos\alpha = J \qquad 2\sin M \sin\epsilon\cos\alpha = K$$
$$-2\cos M \sin\epsilon\cos\alpha = L \qquad V\sin\epsilon\cos\alpha = M$$
$$\text{and} \quad \Delta\delta = \Delta\delta' - \operatorname{tg}\delta\cot\epsilon\,\Delta\epsilon$$

the equation becomes, when we neglect the influence of the Lunar Equation

$$\Delta\delta = J\Delta l + K\Delta e + Le\Delta\pi + M\mu$$

The coefficients of these equations of condition are found in Appendix II, and the method of determining the weights has been explained. By the method of Least Squares the following normal equations result.

$$
\begin{aligned}
+65.55\,\Delta l + 3.16\,\Delta e + 14.09\,e\Delta\pi &= -59.''45 - 91.''6\,\mu \\
+ 3.16\,\Delta l + 196.80\,\Delta e - 43.04\,e\Delta\pi &= - 1.61 + 232.6\,\mu \\
+14.09\,\Delta l - 43.04\,\Delta e + 70.52\,e\Delta\pi &= -24.78 - 154.1\,\mu
\end{aligned}
$$

From these normal equations are derived

Δl	$= -0.''861 \quad -1.''14\,\mu$	Weight 61.9
Δe	$= -0.039 \quad +0.89\,\mu$	168.3
$e\Delta\pi$	$= -0.203 \quad -1.41\,\mu$	57.8

Introducing Professor NEWCOMB's value of the correction to the mass of *Venus*, and computing the probable errors

$$
\begin{aligned}
\Delta l &= -0.''847 \quad \pm 0.''106 \\
\Delta e &= -0.050 \quad \pm 0.064 \\
e\Delta\pi &= -0.186 \quad \pm 0.110
\end{aligned}
$$

while the probable error of the unit of weight is $\pm 0''.834$.

Corresponding to the values of the probable error of a nadir estimation originally used these quantities are

$$
\begin{aligned}
\Delta l &= -0.''803 \quad \pm 0.''104 \\
\Delta e &= -0.063 \quad \pm 0.063 \\
e\Delta\pi &= -0.218 \quad \pm 0.111
\end{aligned}
$$

with the probable error of the unit of weight as $\pm 0''.643$. This again shows that the weight formula needs the addition of a constant to express the true state of the observations, and a comparison with the results from the right-ascensions shows that this constant probably arises from the measurement of the declinations.

To find the values corresponding to the second solution of the equations for da, $d\epsilon$ and $d\varphi$ we have only to add $+0''.04$, $-0''.05$ and $-0''.12$ to the $\Delta\delta$ for the three observers respectively, and after adding the correction for the change in the mass of *Venus*,

$$
\begin{aligned}
\Delta l &= -0.''811 \\
\Delta e &= -0.131 \\
e\Delta\pi &= -0.193
\end{aligned}
$$

Combining the results derived separately from the right-ascensions and declinations we have as representing the entire series

	1st Solution	2d Solution	Probable Error
x	$-0.''171$	$-0.''174$	$\pm 0.''040$
Δl	-1.083	-1.052	± 0.049
Δe	$+0.136$	$+0.129$	± 0.043
$e\Delta\pi$	$+0.134$	$+0.126$	± 0.042

The probable errors are essentially identical for the two solutions, except that Δe in the second solution has $\pm 0''.060$ instead of $\pm 0''.043$ as given above.

Since the value of the coefficient of the Lunar Equation $P = \frac{m}{m+m'} \frac{a}{a' \sin 1''}$ as used in LEVERRIER'S tables is 6″.50, the values equivalent to these determinations of x are 6″.329 and 6″.326 respectively.

If as a check on the computation and to observe the difference in the value of the coefficient in the observations of the different years we build means of all the observations near the first and last quarters of the moon, subtract one from the other, all observations being rejected in which the Lunar Equation does not exceed 3″.50, we find as the correction for the coefficient of the Lunar Equation

1883	$x = -0.071$	Weight 11.7
1884	-0.027	15.8
1885	-0.026	14.4
1886	-0.022	20.0
1887–8	-0.032	22.9

The weights given are proportional to the number of observations that have been used to form the several means.

If we unite these by weights

$$x = -0.0331 = -0''.215 \text{ with a probable error } \pm 0''.034$$

If on the other hand they are united without regard to weights,

$$x = -0.0356 = -0''.231 \text{ with a probable error } \pm 0''.039$$

DEICHMÜLLER'S corrected value as derived from ARGELANDER'S observations in the years 1847–53 is

$$6''.75 \text{ with probable error } \pm 0''.11$$

NEWCOMB'S value derived on the hypothesis, that in order to express the coefficient as a function of the time, LEVERRIER made use of the mean parallax and mean longitude of the sun and moon instead of the true, is

6″.56 with probable error ±0″.04 for Greenwich observations 1851–64
6 .51 " " " ±0 .07 " Washington " 1861–65

and uniting these with LEVERRIER'S result 6″.50, the value representing the whole series is 6″.52 ±0″.023. But in the *Astronomical Journal*, No. 317, Dr. KURT LAVES, on the authority of M. GAILLOT of the Paris Observatory, has shown that LEVERRIER made use of the same formula in his computation that he developed in his theory, and that by reason of a correction his value should be 6″.53 instead of 6″.50, which he used as the foundation of his tables.

The values of the coefficient as derived from both the Bonn and Strassburg observations show wide departures from that given by LEVERRIER, and when compared with each other, the difference is still more marked. This only emphasizes the fact that any correction based on solar observations must be unsafe, and especially when only extending over a short period. The mean of the results of the two series 6″.54 is almost exactly that of LEVERRIER as corrected by M. GAILLOT. Since the correction as given by the Strassburg observations is negative, the error supposed to exist by Professor NEWCOMB in the published ephemerides subsequent to 1864 can hardly be assumed to be present in the *Berliner Jahrbuch* from 1883–8 inclusive.

APPENDIX I.

1883	O	No. of Threads	$\Delta\alpha$ O—C	Merid. Pass. O—C	$\Delta\delta$ O—C	Vert. Diam. O—C	A	B	C	N	N′	N″	Wt.	Remarks
			s	s	″	″				″	″	″		
Jan. 23	S	5.4	0.00	+0.22	. .	. .	. .	. .	. .	. .	. .	. .	. .	
24	"	5	+0.03	−0.17	. .	. .	. .	. .	. .	. .	. .	. .	. .	
31	"	5	+0.16	+0.73	. .	. .	. .	. .	. .	. .	. .	. .	. .	
Feb. 5	"	4	−0.21	−0.08	. .	. .	. .	. .	. .	. .	. .	. .	. .	
7	"	5	0.03	+0.07	. .	. .	. .	. .	. .	. .	. .	. .	. .	
10	"	3.5	0.08	−0.18	+0.18	−3.79	+0.328	−0.660	+1.958	−0.14	+0.64	+0.69	0.89	Image undulating
12	"	5	0.15	+0.23	−1.20	+0.51	. .	. .	. .	. .	. .	. .	. .	Very indist. and undul.
14	"	5	−0.09	0.18	. .	. .	. .	. .	. .	. .	. .	. .	. .	
20	"	5.4	+0.02	+0.26	−0.19	+5.40	0.374	0.511	1.699	−0.58	0.12	0.22	0.77	Nadir on one side
23	"	5	−0.11	−0.11	+0.22	−2.12	0.386	0.463	1.628	+0.59	1.25	1.37	0.77	Nadir on one side
24	"	3.4	0.00	+0.11	0.17	+2.05	0.389	0.445	1.605	−0.52	0.14	0.27	0.76	
27	"	5	0.01	+0.15	+0.16	+0.59	0.400	0.394	1.537	0.46	0.16	0.31	0.79	
Mar. 2	"	4	0.15	−0.02	−0.42	−2.01	0.408	0.341	1.472	0.18	+0.41	0.56	1.01	
3	"	5	−0.05	+0.13	−0.38	+5.32	0.411	0.323	1.451	0.74	−0.15	0.00	1.01	Very undulating
4	"	5	0.00	+0.07	+0.10	1.20	0.414	−0.306	1.458	−0.13	+0.45	0.60	1.01	Extremely undulating
7	"	5	+0.16	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	Unsafe obs. in gap in cl'ds
17	"	3	+0.10	−0.01	. .	. .	. .	. .	. .	. .	. .	. .	. .	Undulating
19	"	5	−0.10	−0.16	. .	. .	. .	. .	. .	. .	. .	. .	. .	
23	"	5.1	0.09	+0.20	+1.11	0.57	0.433	+0.048	1.095	+1.07	+1.51	+1.66	0.99	Very undulating
26	"	5	−0.04	+0.07	. .	. .	0.431	0.104	1.050	−0.80	−0.40	−0.25	0.97	
April 26	"	5	+0.22	−0.43	−0.62	0.83	0.342	0.621	0.703	2.20	1.93	1.83	1.06	
May 7	"	. .	. .	. .	3.42	4.84	. .	. .	. .	. .	. .	. .	. .	Very undulating
13	"	5	−0.12	+0.29	. .	. .	. .	. .	. .	. .	. .	. .	. .	Very indistinct
14	"	5	0.14	0.09	. .	. .	. .	. .	. .	. .	. .	. .	. .	
15	"	5	0.18	+0.14	1.59	1.37	0.240	0.837	0.583	0.75	0.52	0.53	1.14	Very undulating
16	"	5	0.12	−0.10	. .	. .	. .	. .	. .	. .	. .	. .	. .	Very undulating
17	"	5	0.24	+0.05	1.64	3.00	0.288	0.854	0.561	0.62	0.39	0.40	1.17	Very undul. and indist.
18	"	5	0.11	−0.09	1.45	2.38	0.222	0.863	0.555	1.41	1.18	1.19	1.14	
21	"	5	0.14	+0.22	2.56	+2.91	0.204	0.886	0.541	2.43	2.20	2.21	1.14	
22	"	5	0.14	0.09	1.18	−2.91	0.197	0.894	0.537	1.07	0.85	0.86	1.17	
23	"	5	0.15	0.05	1.44	−0.36	0.191	0.901	0.532	1.30	1.08	1.09	1.17	
24	"	5	0.10	+0.26	2.73	+1.04	0.185	0.907	0.528	2.21	2.00	2.01	1.21	Indist. and undulating
25	"	4.5	0.05	−0.03	1.61	+0.40	0.178	0.914	0.524	1.22	1.01	1.02	1.21	
June 1	"	5	0.14	−0.02	2.19	−1.90	0.133	0.951	0.521	1.62	1.42	1.42	1.42	
2	"	. .	. .	. .	0.26	1.02	. .	. .	. .	. .	. .	. .	. .	
4	"	5	0.24	+0.03	0.66	−0.94	0.114	0.966	0.518	0.48	0.28	0.28	1.42	Undulating
14	"	5	−0.08	+0.05	1.65	+0.11	0.049	0.994	0.473	1.25	1.06	1.06	1.42	
15	"	5	+0.24	−0.07	1.70	−1.35	+0.042	0.995	0.472	1.51	1.32	1.32	1.42	
24	"	5	−0.14	0.07	0.68	−2.25	−0.018	0.999	0.470	0.87	0.68	0.66	1.42	
25	"	5.4	0.27	−0.08	0.20	+0.17	0.024	0.998	0.470	0.45	0.26	0.24	1.42	
28	"	5.2	0.02	+0.07	0.92	+0.60	0.045	0.995	0.472	0.53	0.34	0.31	1.42	
29	"	5	0.05	−0.09	1.42	−2.34	0.051	0.993	0.473	1.06	0.87	0.84	1.42	
July 3	"	5	0.19	0.03	−0.01	+0.80	0.078	0.985	0.479	−0.35	−0.16	−0.13	1.42	
4	"	3	0.04	. .	+0.11	. .	0.084	0.982	0.481	+0.47	+0.67	+0.70	1.42	
6	"	5	0.18	−0.02	−1.22	−3.55	0.097	0.975	0.485	−1.06	−0.85	−0.82	1.38	
12	"	5	0.14	+0.03	−1.42	+0.39	0.136	0.951	0.500	1.27	1.05	1.02	1.38	
22	"	5	0.10	+0.06	+0.04	+2.90	0.200	0.892	0.538	0.33	0.09	0.06	1.34	Very undulating
30	"	5	−0.12	−0.16	+0.21	−3.15	−0.247	+0.826	+0.578	−0.31	−0.05	−0.04	1.09	

1883–4		O	No. of Threads	$\Delta\alpha$ O—C	Merid. Pass. O—C	$\Delta\delta$ O—C	Vert. Diam. O—C	A	B	C	N	N′	N″	Wt.	Remarks
				s	s	″	″				″	″	″		
Aug.	2	S	4.5	−0.03	−0.03	−0.86	−3.92	−0.264	+0.798	+0.596	−0.52	−0.25	−0.23	1.34	
	3	"	5	0.20	0.00	1.21	+0.02	0.270	0.787	0.602	2.08	1.81	1.79	1.14	
	4	"	5	0.14	0.00	0.62	−1.99	0.275	0.777	0.608	1.26	0.98	0.96	1.34	
	5	"	5	0.07	+0.05	1.03	−2.87	0.281	0.767	0.614	1.39	1.11	1.09	1.34	
	6	"	5	0.12	−0.04	1.39	+1.00	0.286	0.755	0.621	1.45	1.17	1.14	1.34	
	7	"	5	0.22	−0.02	0.70	−2.66	0.292	0.715	0.628	1.20	0.92	0.89	1.27	
	11	"	5	0.16	+0.03	0.29	+0.71	0.313	0.698	0.657	1.11	0.81	0.77	1.23	
	16	"	5.3	0.20	−0.20	1.62	−2.39	0.338	0.634	0.695	2.20	1.88	1.83	1.04	
	18	"	5	0.11	+0.01	0.98	0.86	0.346	0.606	0.712	1.11	0.78	0.75	1.31	
	19	"	5.4	0.15	−0.15	1.15	1.69	0.351	0.593	0.720	1.50	1.17	1.11	1.31	
	21	"	5.4	0.13	−0.13	0.03	0.15	0.360	0.564	0.738	0.80	0.47	0.40	1.31	
	22	"	5	0.05	+0.03	−1.09	−0.95	0.364	0.549	0.747	−1.43	−1.10	−1.03	1.27	
	24	"	5	0.09	−0.13	+1.13	+1.88	0.372	0.520	0.765	+1.06	+1.40	+1.48	1.27	
	25	"	5	0.05	+0.04	−1.43	−0.40	0.376	0.504	0.775	−1.29	−0.95	−0.87	1.27	
	27	"	5.4	0.07	−0.13	0.95	0.72	0.383	0.474	0.794	0.92	0.57	0.48	1.27	
	30	"	5	0.07	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	
	31	"	5	0.00	+0.03	1.43	−0.78	0.397	0.409	0.836	1.02	0.66	−0.57	1.27	
Sept.	3	"	5	0.05	. .	0.02	+2.87	0.406	+0.359	0.869	0.41	0.04	+0.06	0.76	
Oct.	9	"	5	0.17	+0.36	3.20	+4.18	0.415	−0.296	1.419	4.07	3.45	−3.29	0.75	Very undul. and indist.
	16	"	5	0.06	−0.19	1.22	−5.27	0.395	0.416	1.566	1.80	1.13	0.98	0.76	Through thick clouds
	21	"	5	0.02	−0.22	2.77	2.26	0.377	0.499	1.681	2.70	1.96	1.88	0.58	
	23	"	5	0.00	+0.03	1.31	2.03	0.369	0.530	1.730	1.14	0.38	0.31	0.76	
	26	"	5	0.21	+0.10	−2.30	−0.79	0.356	0.575	1.804	−3.26	−2.48	−2.43	0.80	Indist. and undulating
	27	"	5	0.09	−0.03	+1.73	+0.56	0.352	0.589	1.843	+0.99	+1.78	+1.82	0.79	
Nov.	5	"	5	0.15	−0.10	1.86	−3.30	0.306	0.712	2.073	+0.86	1.67	1.64	0.84	
	10	"	5	0.13	+0.03	+0.11	0.28	0.278	0.771	2.217	−0.36	+0.51	+0.47	0.84	
	24	"	5	0.11	−0.05	−1.83	3.30	0.191	0.900	2.623	−2.17	−1.12	−1.28	0.88	
	27	"	5	0.11	−0.11	+1.58	3.21	0.171	0.921	2.706	+0.89	+1.96	+1.73	0.88	
Dec.	4	"	5	−0.03	+0.08	+0.28	5.29	0.124	0.959	2.878	−0.23	+0.90	+0.66	0.93	
	5	"	5	+0.01	0.04	−1.68	−2.14	0.117	0.964	2.896	2.12	−0.95	−1.19	0.93	
	7	"	6.7	−0.12	+0.45	1.56	+1.22	0.103	0.972	2.938	2.21	−0.99	−1.24	0.93	Scarcely observable on
	15	"	5	0.16	−0.03	0.49	−0.54	0.047	0.994	3.054	0.74	+0.46	+0.21	0.95	account of undulations
	17	"	5	−0.23	. .	−1.53	+0.68	0.034	0.997	3.069	−1.79	−0.57	−0.82	0.95	
	18	"	5	+0.03	. .	+2.33	+0.89	−0.026	0.998	3.075	+1.83	+3.08	+2.83	0.95	
1884 Jan.	24	"	5	−0.28	. .	+2 31	−2.04	+0.017	0.999	3.081	+1.84	+3.09	+2.83	0.95	
	3	"	5	0.00	+0.25	. .	. .	. .	. .	. .	. .	. .	. .	. .	
	5	"	5	0.12	−0.06	−1.36	−2.89	0.101	0.974	2.943	−1.77	−0.60	−0.88	0.93	
	9	"	5	0.07	0.11	0.77	0.89	0.129	0.956	2.861	1.24	0.07	0.37	0.93	
	10	"	5	0.11	−0.01	1.55	−1.73	0.136	0.951	2.837	1.58	0.43	0.72	0.93	Very undulating
	11	"	5	0.07	+0.39	1.33	+3.48	0.142	0.947	2.814	1.43	0.30	0.58	0.93	Extremely undulating
	18	"	5	0.05	0.05	0.90	+2.53	0.189	0.902	2.630	1.40	−0.34	0.49	0.89	and indistinct
	25	"	5	0.07	+0.08	0.49	−1.28	0.235	0.845	2.428	0.90	+0.08	−0.02	0.88	
	31	"	5	0.05	0.11	0.60	1.01	0.272	0.784	2.251	0.69	+0.19	+0.10	0.88	
Feb.	4	"	5	0.06	0.28	1.75	−3.09	0.292	0.738	2.135	1.78	−0.90	−0.91	0.86	
	5	"	5	0.08	+0.02	1.60	+1.21	0.300	0.726	2.106	1.94	−1.07	−1.08	0.86	
	6	"	5	−0.21	0.00	0.66	−2.47	0.306	0.713	2.076	0.40	+0.46	+0.46	0.83	
	12	"	5	+0.07	−0.14	1.12	+2.33	0.338	0.634	1.994	1.78	−1.01	−0.98	0.83	
	17	"	5	−0.15	+0.23	0.86	+2.55	0.361	0.560	1.780	0.77	0.05	0.00	0.77	Very undulating
	19	"	5	+0.06	−0.12	0.68	−1.85	0.369	0.530	1.730	1.32	0.63	0.57	0.80	Very indistinct
	20	"	5	−0.02	+0.22	−1.46	+2.05	0.373	0.515	1.705	−1.68	−0.98	−0.91	0.80	
	27	"	5	0.11	0.02	+0.88	+1.73	0.399	0.399	1.542	+0.81	+1.43	+1.53	0.80	Very undulating
	28	"	5	0.07	0.08	−0.97	−1.91	0.400	0.390	1.520	−1.28	−0.66	−0.56	0.80	
Mar.	2	"	5	0.23	0.21	2.70	+1.10	0.410	0.328	1.456	1.57	−0.98	−0.86	1.01	
	3	"	5	0.09	+0.02	0.41	2.59	0.413	0.311	1.435	0.14	+0.44	+0.57	1.01	R 4 S 4
	4	"	5	0.06	−0.07	1.81	0.01	0.415	0.294	1.415	2.17	−1.60	−1.47	1.01	
	13	"	5	0.02	+0.13	−1.04	0.83	0.430	0.127	1.245	−1.63	−1.14	−1.00	1.01	
	14	"	5	0.17	0.37	+0.80	+4.58	0.431	0.109	1.228	+1.64	+2.13	+2.27	0.99	R 3 S 3
	15	"	5	0.06	0.13	−2.78	−0.66	0.431	0.090	1.211	−2.64	−2.16	−2.01	0.99	R 3 S 3
	16	"	5	−0.08	+0.03	−1.85	0.53	0.432	0.071	1.194	−2.05	−1.58	−1.43	0.99	R 3 S 3
	17	"	5	0.00	−0.02	+2.79	−3.02	+0.433	−0.051	+1.177	+2.07	+2.53	+2.68	0.97	

1884	O	No. of Threads	$\Delta\alpha$ O—C	Merid. Pass. O—C	$\Delta\delta$ O—C	Vert. Diam. O—C	A	B	C	N	N′	N″	Wt.	Remarks
			s	s	″	″				″	″	″		
Mar. 18	S	5	−0.10	−0.11	+0.48	−0.24	+0.434	−0.032	+1.161	+0.87	+1.32	+1.47	0.97	R3 S2
19	"	5	+0.03	0.07	−1.35	+0.01	0.434	−0.023	1.145	−1.80	−1.36	−1.21	0.97	
22	"	5	+0.11	0.07	2.10	0.20	0.433	+0.044	1.098	3.04	−2.60	−2.45	0.97	R3 S2
23	"	5	0.07	−0.13	0.07	0.76	0.433	0.062	1.083	0.31	+0.12	+0.27	0.95	
24	"	5	+0.06	+0.18	3.32	0.63	0.430	0.081	1.069	4.41	−3.98	−3.83	0.97	R3 S2
28	"	5	−0.07	+0.05	2.22	+0.09	0.430	0.156	1.012	1.98	1 58	1.43	1.01	R3 S2
29	"	5	0.00	−0.05	2.35	−1.97	0.429	0.174	0.998	2.56	2.17	2.02	1.01	R3 S3
30	"	5	+0.01	. .	1.19	+0.73	0.426	0.192	0.984	1.94	1.56	1.41	1.01	R3 S3
31	"	5	−0.01	+0.30	2.76	−3.16	0.424	0.210	0.971	3.39	3.02	2.87	0.97	R3 S3
April 1	"	5	+0.01	0.22	2.41	−0.23	0.423	0.228	0.958	2.67	2.30	2.14	0.99	
3	"	5	+0.05	0.09	2.62	+0.31	0.419	0.264	0.936	3.12	2.76	2.60	1.01	R4 S4
9	"	5	−0.11	0.27	−1.02	+1.81	0.404	0.369	0.862	1.02	0.68	−0.52	1.04	R3 S3
12	"	5	+0.04	0.04	+0.50	−2.31	0.395	0.420	0.829	0.39	0.00	+0.08	1.01	R3 S2
May 22	"	4.5	−0.15	+0.08	−1.04	0.07	0.193	0.899	0.533	−1.08	−0.86	−0.86	1.17	R3 S2
23	"	5	0.12	−0.01	+0.37	−1.09	0.186	0.906	0.529	+0.25	+0.47	+0.47	1.17	R3 S3
24	"	5	−0.16	. .	−1.90	+1.12	0.180	0.912	0.525	−1.40	−1.19	−1.20	1.17	
28	"	5	+0.02	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	
30	"	5	−0.21	0.18	0.14	−0.68	0.142	0.947	0.503	0.11	+0.09	+0.09	1.21	
June 13	"	5	0.06	0.02	1.17	1.01	0.050	0.993	0.473	1.47	−1.28	−1.26	1.42	R2 S2
14	"	8.5	0.03	−0.01	3.09	−1.82	0.044	0.995	0.472	2.88	2.69	2.66	1.42	R2 S2
19	"	5	0.03	+0.05	3.58	+1.73	+0.010	0.999	0.469	3.36	3.17	3.14	1.42	R2 S3
21	"	5	0.26	−0.08	−0.90	−3.25	−0.002	1.000	0.469	1.22	−1.03	−1.00	1.42	Through clouds, R2 S2
24	"	5	0.05	0.09	+0.26	2.38	0.023	0.998	0.470	0.06	+0.13	+0.16	1.42	R2 S2
25	"	. .	. .	. .	−1.19	3.13	. .	. .	. .	. .	. .	. .	. .	R2 S2
27	"	5	0.06	0.01	2.37	1.21	0.043	0.995	0.472	2.16	−1.97	−1.94	1.42	R3 S2
28	"	5	0.02	0.14	0.16	1.96	0.049	0.994	0.473	0.45	0.26	0.23	1.42	R2 S2
29	"	5	0.03	0.01	0.79	4.03	0.056	0.992	0.474	1.10	0.91	0.88	1.42	R2 S3
30	"	5	0.04	0.01	1.75	−0.38	0.063	0.990	0.476	1.53	1.34	1.31	1.42	R2 S3
July 1	"	5	0.03	0.01	2.62	+0.01	0.069	0.988	0.477	2.39	2.18	2.15	1.42	R3 S3
2	"	5	0.10	0.00	0.40	−0.70	0.076	0.986	0.479	0.77	0.56	0.53	1.42	R3 S3
3	"	5	−0.07	0.05	0.68	3.30	0.082	0.983	0.481	1.03	0.82	0.79	1.42	R2 S3
4	"	5	+0.04	0.15	2.38	5.15	0.089	0.980	0.482	2.05	1.84	1.81	1.42	Cirri R2 S4
5	"	5	−0.02	−0.14	2.25	1.34	0.096	0.976	0.485	2.00	1.79	1.76	1.42	
7	"	5	0.06	+0.01	−1.38	0.77	0.108	0.970	0.489	1.75	1.50	1.47	1.42	R3 S3
8	"	5	0.08	−0.05	+0.11	−0.65	0.115	0.966	0.491	0.26	0.04	0.01	1.42	R3 S3
9	"	5	−0.06	+0.03	−1.84	+0.39	0.121	0.961	0.494	1.65	1.43	1.40	1.42	R3 S3
11	"	5	+0.01	+0.18	1.35	0.48	0.134	0.952	0.500	1.02	0.80	0.78	1.42	R3 S3
12	"	5	−0.11	. .	0.51	+1.29	0.140	0.948	0.503	0.95	0.73	0.71	1.38	
16	"	5	0.04	−0.11	0.34	−3.26	0.166	0.926	0.517	0.64	0.41	0.39	1.38	
18	"	5	0.06	+0.12	2.92	+2.10	0.179	0.914	0.524	2.75	2.52	2.50	1.38	R3 S4
23	"	5	0.05	−0.24	1.66	−1.39	0.210	0.879	0.546	1.47	1.23	1.22	1.38	R3 S3
31	"	5	−0.08	. .	0.67	0.11	0.257	0.810	0.588	1.15	0.88	0.86	1.34	
Sept. 2	"	5.7	+0.02	0.33	1.57	2.60	0.405	0.363	0.866	1.06	0.70	0.59	0.76	Through clouds
10	"	5	−0.09	−0.04	1.58	−2.19	0.423	0.224	0.962	1.76	1.34	1.16	0.72	R3 S2
12	"	5.3	0.15	+0.20	2.18	+3.79	0.426	0.187	0.988	3.24	2.81	2.62	0.74	R4 S4
13	"	5	0.15	+0.15	0.51	−0.80	0.428	0.170	1.001	1.57	1.14	0.95	0.72	
15	"	5	0.12	−0.04	2.14	+0.76	0.430	0.133	1.028	2.53	2.08	1.89	0.73	R3 S3
17	"	5	0.02	+0.32	0.97	−0.04	0.431	0.097	1.056	0.71	0.25	0.05	0.74	R3 S4
18	"	5	0.09	+0.04	1.04	1.73	0.432	0.078	1.071	1.72	1.25	1.05	0.74	
20	"	5	0.16	−0.12	1.92	2.40	0.433	0.041	1.100	3.06	2.57	2.36	0.74	R3 S3
21	"	5	0.16	+0.18	1.85	0.64	0.434	0.022	1.116	2.99	2.51	2.30	0.74	
22	"	5	0.05	−0.07	1.77	−1.13	0.434	+0.002	1.131	1.07	0.58	0.36	0.73	
24	"	5	0.13	+0.05	3.30	+3.97	0.433	−0.034	1.163	3.79	3.28	3.07	0.75	R3–4 S3–4
25	"	5	0.17	0.02	2.58	+1.43	0.433	0.053	1.179	3.32	2.70	2.59	0.74	R4 S4
26	"	5	0.16	0.08	1.30	−1.20	0.432	0.071	1.195	1.98	1.45	1.25	0.74	R2 S3
27	"	5	0.19	+0.16	1.19	+1.92	0.432	0.090	1.212	2 53	2.00	1.80	0.74	R4 S4
29	"	5	0.13	−0.04	0.72	−3.06	0.430	0.128	1.246	1.67	1.13	0.94	0.72	
30	"	5	0.16	+0.16	1.95	+0.28	0.429	0.146	1.263	3.09	2.54	2.35	0.74	
Oct. 21	"	5	0.23	0.21	−1.37	−2.04	0.374	0.511	1.699	2.38	−1.63	−1.55	0.77	
22	"	5	−0.21	+0.08	+0.13	+0.32	−0.370	−0.526	+1.724	−0.76	0.00	+0.07	0.77	R3 S3

1884-85	O	No. of Threads	$\Delta\alpha$ O—C	Merid. Pass. O—C	$\Delta\delta$ O—C	Vert. Diam. O—C	A	B	C	N	N′	N″	Wt.	Remarks
			s	s	″	″				″	″	″		
Oct. 23	S	5	−0.23	−0.10	−1.55	−0.78	−0.366	−0.542	+1.750	−2.96	−2.20	−2.14	0.79	R 3 S 3
24	"	5.4	0.23	0.06	1.33	−2.05	0.362	0.556	1.774	2.73	1.96	1.90	0.79	Through clouds, R 2 S 2
25	"	6	0.05	. .	2.23	+0.62	0.357	0.571	1.798	2.23	1.44	1.39	0.80	R 3 S 3
Nov. 3	"	5	0.22	. .	1.80	−2.52	0.313	0.694	2.038	2.61	−1.80	−1.80	0.81	
6	"	5	0.02	0.01	0.86	+0.35	0.297	0.733	2.124	0.74	+0.10	+0.07	0.83	R 3 S 3
15	"	5	0.14	0.03	1.00	+1.39	0.244	0.830	2.385	1.38	−0.40	−0.48	0.84	R 3-4 S 3-4
17	"	5	−0.26	−0.12	1.18	−0.44	0.232	0.849	2.444	2.30	−1.31	−1.40	0.83	R 3 S 2
Dec. 8	"	5	+0.02	+0.28	0.71	+0.21	0.092	0.978	2.969	0.62	+0.55	+0.30	0.93	R 4 S 4
10	"	5	−0.06	0.08	1.91	−1.04	0.078	0.985	3.000	1.93	−0.72	−0.97	0.95	R 3 S 3
13	"	5	0.16	0.13	0.86	0.28	0.059	0.990	3.039	1.31	0.10	0.35	0.95	R 3 S 3
14	"	4.5	0.35	0.16	3.32	0.92	0.049	0.994	3.051	3.91	−2.68	−2.93	0.95	R 4 S 4
16	"	5	0.22	0.24	−0.85	1.87	0.035	0.996	3.066	−0.95	+0.27	+0.02	0.95	R 2 S 2
18	"	5	0.19	0.06	+0.18	1.89	−0.021	0.998	3.078	+0.13	1.37	1.12	0.95	R 3 S 4
28	"	5	0.03	0.13	−0.16	2.61	+0.050	0.993	3.051	−0.53	+0.71	+0.45	0.93	R 4 S 4
1885 Jan. 3	"	3.5	0.11	+0.02	3.32	0.47	0.093	0.978	2.966	3.59	−2.38	−2.65	0.93	
4	"	5	0.10	−0.04	1.30	2.53	0.096	0.974	2.949	1.21	0.00	−0.27	0.93	R 3 S 3
9	"	5.4	0.13	0.00	0.82	1.50	0.133	0.952	2.842	0.64	+0.53	+0.23	0.93	R 3 S 3
15	"	5	0.18	+0.19	2.53	0.04	0.174	0.918	2.691	2.53	−1.41	−1.62	0.91	R 3 S 3
18	"	4.5	0.26	0.21	1.63	1.26	0.195	0.897	2.610	1.36	0.29	0.46	0.91	R 4 S 4
20	"	3.2	0.13	0.18	2.09	−1.41	0.208	0.881	2.552	1.79	0.72	0.87	0.91	R 3 S 3
21	"	5	0.10	0.33	2.32	+0.39	0.215	0.873	2.524	2.12	1.07	1.20	0.91	
22	"	4	0.15	0.09	2.16	+2.45	0.221	0.864	2.494	2.17	−1.12	−1.23	0.91	
27	"	5	0.17	+0.01	0.30	−4.17	0.252	0.818	2.346	0.19	+0.80	+0.73	0.89	R 3 S 3
28	"	5	−0.09	−0.10	2.97	0.63	0.258	0.808	2.316	2.76	−1.82	−1.89	0.88	R 2 S 3
29	"	5	+0.01	+0.09	1.36	0.10	0.265	0.797	2.287	1.54	0.63	0.69	0.88	R 2-3 S 2-3
Feb. 2	"	5	−0.08	+0.11	1.19	−1.05	0.287	0.753	2.171	1.40	−0.56	−0.60	0.86	Through mist, R 3 S 3
6	"	5	0.15	−0.03	0.57	+0.40	0.310	0.704	2.055	0.44	+0.38	+0.36	0.83	
8	"	5	−0.09	0.05	0.38	−0.54	0.321	0.678	1.998	0.13	+0.67	+0.67	0.83	
24	"	5.3	+0.01	−0.06	1.82	+3.27	0.391	0.437	1.592	2.08	−1.44	−1.37	0.80	
25	"	5	+0.16	+0.36	1.05	+2.66	0.395	0.420	1.570	2.63	2.01	1.93	0.80	R 4 S 4
26	"	5	−0.01	0.01	0.99	−0.99	0.398	0.403	1.547	1.56	0.94	0.86	0.80	R 3 S 3
27	"	5	+0.18	+0.58	2.74	−0.83	0.401	0.385	1.525	4.03	3.42	3.33	0.79	R 4 S 4
Mar. 2	"	5	0.09	−0.03	2.24	+1.02	0.410	0.332	1.461	3.02	2.43	2.31	1.01	R 4 S 4
10	"	5	+0.09	−0.13	1.08	−2.83	0.426	0.187	1.304	2.32	−1.79	−1.64	1.01	
12	"	5	−0.13	+0.13	−0.23	−1.46	0.429	0.150	1.267	0.05	+0.46	+0.61	0.99	R 3 S 3
13	"	5	−0.02	0.00	+0.32	+0.17	0.430	0.132	1.250	0.21	+0.29	+0.44	1.01	Undulating; poor image
14	"	5	+0.01	+0.32	−2.41	1.87	0.431	0.113	1.232	3.12	−2.62	−2.47	1.01	R 4 S 4
16	"	5.4	+0.11	0.08	0.91	+2.19	0.432	0.075	1.198	1.83	1.34	1.19	0.97	R 3 S 3
17	"	5	−0.05	0.12	2.87	−1.29	0.433	−0.056	1.181	2.75	2.28	2.13	0.99	R 3 S 3
20	"	5	0.05	+0.07	1.83	1.35	0.434	+0.001	1.133	1.70	1.25	1.10	0.97	
31	"	5	0.08	−0.01	2.27	−0.81	0.425	0.206	0.975	2.43	2.05	1.90	1.01	
April 1	"	5	0.06	−0.01	1.43	+0.22	0.423	0.224	0.962	1.72	1.35	1.19	1.01	R 4 S 4
2	"	5	0.05	+0.04	1.13	−1.73	0.421	0.242	0.948	1.48	1.11	0.95	0.99	R 2 S 3
3	"	5	−0.09	−0.04	1.53	1.48	0.419	0.260	0.936	1.63	1.26	1.10	1.04	R 3 S 3
4	"	6.5	+0.02	+0.19	0.55	−1.90	0.417	0.279	0.924	0.86	0.50	0.34	1.01	
15	"	5	−0.03	0.06	0.98	+4.80	0.385	0.465	0.800	0.96	0.65	0.51	1.04	R 3 S 3
18	"	5	0.15	+0.04	4.06	−0.87	0.374	0.512	0.771	4.30	4.01	3.89	1.04	
19	"	5	0.00	−0.05	2.28	0.50	0.370	0.528	0.761	2.94	2.65	2.54	1.06	R 2-3 S 2-3
21	"	4.5	0.05	0.00	1.80	0.80	0.362	0.557	0.742	2.18	1.89	1.80	1.04	R 2 S 2
22	K	5	−0.06	0.06	1.01	−0.59	0.358	0.571	0.733	1.34	1.06	0.97	0.97	
June 2	S	5	+0.07	. .	1.43	+1.66	0.124	0.959	0.495	1.56	1.35	1.31	1.42	
3	"	5	−0.03	0.08	2.19	+0.08	0.117	0.964	0.493	2.14	1.94	1.90	1.42	R 2-3 S 2-3
4	"	5	0.00	0.14	2.30	−0.09	0.111	0.968	0.490	2.29	2.09	2.06	1.42	Images good
5	"	5	−0.05	−0.13	1.78	0.10	0.104	0.971	0.488	1.69	1.49	−1.46	1.42	
6	"	5	+0.04	+0.10	0.15	0.89	0.098	0.975	0.485	0.20	0.01	+0.01	1.42	
7	"	5	+0.07	−0.20	1.49	0.72	0.092	0.978	0.483	1.57	1.38	−1.36	1.42	
8	"	5	−0.05	+0.01	1.47	2.67	0.085	0.981	0.481	1.39	1.20	1.19	1.42	R 2 S 2
9	"	5	−0.04	−0.04	1.56	0.93	0.079	0.985	0.479	1.49	1.30	1.29	1.42	R 2 S 2
11	"	5	+0.05	+0.01	1.79	0.63	0.065	0.990	0.476	1.81	1.62	1.61	1.42	R 3 S 3
12	"	5	−0.06	+0.07	−1.60	−0.07	+0.059	+0.991	+0.475	−1.51	−1.32	−1.31	1.42	R 2 S 2

1885–86	O	No. of Threads	$\Delta\alpha$ O—C	Merid. Pass. O—C	$\Delta\delta$ O—C	Vert. Diam. O—C	A	B	C	N	N′	N″	Wt.	Remarks
			s	s	″	″				″	″	″		
June 13	S	4	−0.10	+0.05	−2.42	−0.71	+0.053	+0.993	+0.474	−2.30	−2.11	−2.10	1.42	R3 S3
14	"	4.5	0.05	−0.07	1.00	0.50	0.046	0.995	0.473	0.93	0.74	0.74	1.42	
15	"	3.5	−0.03	0.16	1.64	−1.14	0.039	0.996	0.472	1.57	1.38	1.38	1.42	
16	"	5.4	+0.07	0.11	1.51	+0.09	0.032	0.997	0.471	1.49	1.30	1.30	1.42	
17	"	5.4	−0.09	0.01	1.74	−2.30	0.025	0.998	0.470	1.65	1.46	1.46	1.42	R2 S2. Through thick
19	"	5	0.11	0.05	1.14	−0.61	+0.012	0.999	0.470	1.06	0.87	0.88	1.42	clouds
23	"	5	0.14	−0.06	−0.10	+0.39	−0.014	0.999	0.470	−0.58	−0.39	−0.40	1.42	
24	"	5	0.19	+0.07	+1.01	+4.34	0.021	0.998	0.470	+0.50	+0.69	+0.72	1.42	R3 S3
25	"	5	0.18	−0.15	−1.52	−1.15	0.028	0.997	0.471	−2.03	−1.84	−1.81	1.42	
26	"	5	0.08	0.00	1.61	1.41	0.034	0.996	0.471	2.09	1.90	1.87	1.42	
27	"	4	0.06	. .	3.63	−3.53	0.041	0.995	0.472	4.10	3.91	3.88	1.42	R2–3 S3
July 9	"	5	0.12	0.03	0.42	+3.73	0.119	0.962	0.493	1.02	0.80	0.77	1.42	
10	"	5	0.00	0.19	1.42	−1.65	0.126	0.958	0.496	1.80	1.58	1.55	1.42	
11	"	5	0.15	0.09	1.15	0.30	0.132	0.953	0.499	1.83	1.61	1.58	1.42	
23	"	5	0.05	−0.10	0.70	1.03	0.208	0.881	0.544	1.21	0.97	0.96	1.38	R2 S1
24	"	5	−0.10	+0.01	0.85	2.21	0.214	0.873	0.549	1.52	1.28	1.27	1.38	
28	"	5.3	+0.06	+0.17	0.78	1.77	0.238	0.840	0.570	0.89	0.63	0.62	1.34	
31	"	5	−0.08	−0.07	1.70	2.71	0.256	0.812	0.587	1.81	1.54	1.53	1.34	
Aug. 1	"	5	0.06	−0.02	0.75	1.24	0.262	0.802	0.593	0.77	0.50	0.48	1.34	[observable
2	K	5	0.11	+0.06	0.48	0.38	0.267	0.792	0.598	0.71	0.44	0.41	2.00	R4 S4–5. Scarcely
3	S	5	0.05	−0.10	0.70	1.62	0.272	0.782	0.605	0.69	0.42	0.40	1.31	R2–3 S2–3
10	K	5	0.14	0.10	. .	. .	. .	. .	. .	. .	. .	. .	. .	
12	"	5.1	0.08	0.04	0.41	1.06	0.321	0.679	0.667	0.55	0.25	0.22	2.00	Quite indist. R4–5 S5
13	"	5	0.09	0.10	1.14	1.12	0.326	0.666	0.675	1.35	1.04	1.01	1.89	R4 S3–4
15	"	5	0.07	0.11	1.13	−0.35	0.335	0.641	0.691	1.26	0.95	0.91	2.00	S4
17	"	5	0.15	0.15	−0.56	+0.30	0.344	0.613	0.708	1.10	0.78	0.74	1.89	R4–5 S4–5. Scarcely
25	"	8	0.07	0.08	+0.09	−1.80	0.377	0.499	0.780	−0.57	−0.22	−0.16	1.89	observable
26	"	5	0.10	. .	+0.92	0.08	0.381	0.482	0.790	+0.09	+0.45	+0.51	1.89	R4–5 S4–5. Very unsafe
Sept. 3	S	5	0.06	0.13	−1.17	−1.67	0.407	0.350	0.874	−1.78	−1.41	−1.28	0.76	Cirri R2 S2
10	K	6	0.15	0.02	1.38	+0.28	0.423	0.228	0.958	2.06	−1.64	−1.46	1.09	R3–4 S3
13	"	7	0.08	0.05	−0.11	−0.29	0.428	0.174	0.998	0.36	+0.07	+0.26	1.29	R2–3 S3–4
14	"	5	0.16	0.06	+0.89	+0.61	0.429	0.157	1.011	0.35	+0.09	0.28	1.24	
15	"	5	0.14	−0.04	+0.50	−1.26	0.429	0.148	1.025	0.61	−0.17	+0.02	1.24	R4 S4
16	"	6	0.12	+0.04	−0.71	1.87	0.430	0.119	1.039	1.69	1.25	−1.04	1.24	
17	"	9	0.20	−0.01	0.22	0.46	0.431	0.101	1.053	1.25	0.80	0.59	1.24	R4 S4 Scarcely observ-
18	"	10	0.18	0.00	0.70	0.35	0.432	0.083	1.067	2.08	1.62	1.41	1.24	able
22	"	5	0.16	−0.10	−0.66	−0.35	0.434	+0.008	1.127	1.91	−1.41	−1.19	1.24	R4–5 S4–5
23	"	5	−0.14	+0.05	+0.35	+0.06	0.434	−0.011	1.143	−0.31	+0.19	+0.41	1.24	R4 S4
Oct. 14	"	5	+0.04	+0.03	+0.39	−1.35	0.400	0.391	1.533	+0.88	+1.54	+1.66	1.24	Thro' clouds. R2–3 S2–3
16	"	8	−0.18	+0.06	−2.84	+2.17	0.393	0.425	1.578	−4.08	−3.40	−3.29	1.29	R4–5 S4–5
17	"	5	0.23	−0.10	0.93	−4.23	0.390	0.442	1.600	2.46	1.76	1.65	1.29	R2 S2–3
19	"	10.5	0.21	+0.03	2.59	0.31	0.383	0.475	1.646	3.55	2.83	2.73	1.29	Scarcely observable
Nov. 2	"	10.9	0.20	+0.25	. .	. .	. .	. .	. .	. .	. .	. .	. .	R4–5 S5
3	"	5	0.11	+0.03	2.28	0.35	0.315	0.691	2.031	2.58	−1.77	−1.77	1.29	Very undul. and indist.
Dec. 2	S	5	0.17	. .	0.03	1.63	0.134	0.952	2.842	0.59	+0.55	+0.34	0.93	
3	"	5	0.08	. .	1.76	−6.13	0.127	0.957	2.866	2.14	−0.98	−1.20	0.93	
4	"	5	0.22	−0.06	2.10	+1.46	0.120	0.962	2.888	2.73	1.58	1.80	0.93	R3 S4
9	"	5	0.23	+0.03	1.25	−1.70	0.086	0.981	2.980	1.79	0.56	0.81	0.93	Image not sharp
19	"	5	0.17	−0.11	1.57	2.68	−0.015	0.999	3.081	1.51	−0.25	−0.51	0.95	
27	"	5	0.15	0.15	0.43	3.93	+0.041	0.996	3.060	0.27	+0.98	+0.72	0.93	
28	"	5.2	0.37	0.04	1.37	3.95	0.049	0.994	3.051	1.03	+0.22	−0.04	0.93	R4 S4
1886 Jan. 6	"	5	0.20	0.02	1.37	−3.18	0.111	0.968	2.913	1.35	−0.20	0.49	0.93	R3 S3
11	"	5	0.17	0.02	6.37	+1.48	0.146	0.944	2.803	6.33	−5.18	−5.44	0.93	R4 S4
13	"	5	0.13	−0.20	0.54	−4.39	0.160	0.932	2.753	0.57	+0.55	+0.32	0.91	R4 S4
Feb. 4	"	5	0.23	+0.01	1.14	−1.18	0.297	0.732	2.119	0.12	0.73	0.71	0.84	R4 S4
8	K	5.4	0.11	0.15	−0.91	+1.16	0.321	0.678	2.006	−0.81	0.03	0.03	0.75	R3 S3
9	"	5	0.28	0.26	+0.69	−0.57	0.325	0.668	1.978	+1.62	+2.45	+2.46	0.75	R5 S5
14	S	6.5	0.21	+0.35	−2.83	+3.20	0.349	0.597	1.922	−1.77	−1.02	−0.99	0.81	
22	"	5	0.06	−0.13	2.72	−0.19	0.383	0.474	1.645	2.41	1.73	1.66	0.80	R4
24	"	5	−0.07	−0.13	−1.38	−1.47	+0.390	−0.441	+1.598	−1.44	−0.78	−0.70	0.80	R3 S4

1886	O	No. of Threads	$\Delta\alpha$ O—C	Merid. Pass. O—C	$\Delta\delta$ O—C	Vert. Diam. O—C	A	B	C	N	N′	N″	Wt.	Remarks
			s	s	″	″				″	″	″		
Feb. 25	S	5	−0.09	−0.18	−0.01	−3.04	+0.394	−0.424	+1.575	+0.05	+0.69	+0.77	0.79	R3 S3
Mar. 1	K	5	−0.13	+0.28	. .	. .	. .	. .	. .	. .	. .	. .	. .	
4	"	5	+0.04	+0.11	0.67	−0.24	0.414	0.302	1.425	−0.97	−0.43	−0.28	0.97	
7	"	5	−0.21	−0.23	0.89	+0.42	0.421	0.248	1.366	+0.37	+0.94	+1.09	1.00	
8	"	5	0.14	+0.10	2.11	−0.41	0.423	0.228	1.346	−1.72	−1.16	−1.01	1.00	
11	"	5	0.18	0.00	1.89	+2.77	0.428	0.173	1.290	1.25	−0.71	−0.56	1.00	R4 S4 [R4-5 S4-5
13	"	5	0.13	+0.12	1.29	+2.02	0.430	0.138	1.254	−0.51	0.00	+0.15	1.00	Scarcely observable
17	"	5	−0.15	−0.08	−0.63	−0.09	0.433	0.061	1.185	+0.28	+0.76	0.91	1.00	
18	"	5	+0.02	. .	+1.84	. .	0.433	0.042	1.169	1.19	1.67	1.82	1.00	R4 S3 [R4-5 S4-5
19	"	4	−0.24	. .	−0.73	+3.20	0.434	0.023	1.152	+0.30	0.77	0.92	1.00	Scarcely observable
20	"	5	0.11	−0.18	0.38	0.02	0.434	−0.004	1.137	−0.19	+0.26	+0.41	0.95	R2-3 S2-3
24	"	5	0.13	+0.05	1.43	+0.91	0.432	+0.072	1.076	0.65	−0.22	−0.07	0.95	
25	"	5.4	0.06	+0.03	3.00	−3.46	0.432	0.091	1.061	−2.67	−2.26	−2.11	0.88	R3-4 S4
27	"	10	0.17	−0.11	−0.15	0.76	0.430	0.128	1.033	+0.42	+0 82	+0.97	1.00	R2-3 S2-3
28	"	10	−0.05	0.03	+0.42	−1.55	0.429	0.147	1.018	0.21	0.60	0.75	0.92	
30	"	10	+0.01	. .	+2.65	. .	0.427	0.178	0.991	+2.53	2.91	3.06	1.00	Very undulating
31	"	9.6	−0.09	−0.04	−0.64	+1.82	0.425	0.201	0.978	−0.13	0.25	0.40	0.97	R3-4 S3-4
Apr. 1	"	10	−0.17	+0.01	−0.84	0.74	0.424	0.219	0.965	−0.30	0.08	0.23	1.03	
2	W	10	+0.02	−0.01	+0.75	1.88	0.422	0.238	0.952	+0.08	0.45	0.60	1.01	R3-4 S3-4
3	K	9.8	−0.11	+0.08	−0.88	3.41	0.420	0.256	0.939	−0.24	+0.12	+0.27	1.00	
5	"	10.8	0.13	0.04	1.82	1.04	0.415	0.292	0.914	1.06	−0.71	−0.56	1.03	
7	"	10.7	0.08	0.01	0.64	+1.30	0.411	0.325	0.890	0.69	0.34	0.19	1.03	R4-5 S4-5
8	"	9	0.18	0.14	−1.50	−0.25	0.408	0.344	0.879	−0.94	−0.61	−0.45	1.03	R4-5 S4-5
11	"	9.6	0.14	+0.15	+0.44	+1.00	0.399	0.395	0.845	+1.23	+1.56	+1.71	1.03	R4-5 S4-5
12	"	10.9	0.09	−0.11	−2.47	−0.95	0.396	0.412	0.834	−1.98	−1.66	−1.52	1.03	Thro' mist. R2-3 S2-3
14	"	10.6	0.10	+0.21	1.44	+1.90	0.390	0.445	0.813	1.41	1.09	0.96	1.03	
15	"	10	0.09	. .	1.55	−1.29	0.386	0.461	0.803	1.59	1.27	1.14	1.03	R3 S3
20	"	10.9	0.11	0.02	1.42	+0.04	0.367	0.539	0.754	0.86	−0.57	−0.47	1.06	
23	"	4.10	0.07	0.04	0.57	−0.67	0.355	0.582	0.727	0.24	+0.05	+0.13	1.06	
24	"	10	0.09	0.03	0.87	+0.09	0.350	0.595	0.718	0.95	−0.67	−0.59	1.09	
25	"	10.8	0.19	+0.26	−1.61	−2.24	0.345	0.609	0.709	−1.18	−0.90	−0.83	1.06	R4 S4-5
26	"	5.4	0.01	−0.04	+0.85	1.75	0.341	0.624	0.701	+0.86	+1.14	+1.21	1.06	
27	W	5.10	0.12	+0.10	−0.30	2.09	0.336	0.638	0.692	0.26	0.54	0.60	1.06	
28	"	10	0.27	. .	0.05	0.76	0.332	0.651	0.684	+0.74	+1.02	+1.08	1.03	R4 S4
May 2	"	10.11	0.02	−0.01	−0.65	−3.10	0.311	0.702	0.653	−1.11	−0.83	−0.78	1.06	
3	"	11	0.05	−0.02	+0.36	+2.86	0.305	0.714	0.646	+0.57	+0.85	+0.89	1.06	
4	K	10.5	0.08	+0.14	−0.73	−0.78	0.300	0.726	0.639	−0.39	−0.12	−0.09	1.13	Ext. unsafe. R4-5 S5
6	"	10.7	0.13	0.09	+0.53	+0.88	0.292	0.743	0.625	+0.56	+0.84	+0.86	1.16	R4 S4-5
7	"	10.7	0.14	0.00	+0.78	−2.01	0.284	0.759	0.618	+0.84	1.10	1.12	1.16	R3 S3
8	"	10.5	0.21	+0.26	−0.96	+0.01	0.278	0.771	0.612	−0.09	0.16	0.17	1.13	Extremely unsafe
9	W	11.12	0.05	−0.11	−0.38	−2.04	0.273	0.782	0.605	−0.18	0.07	0.08	1.06	
10	"	11.12	0.19	0.16	+0.59	3.19	0.268	0.792	0.599	+0.81	1.06	1.07	1.06	
18	"	11.12	0.13	−0.02	+0.06	−1.83	0.220	0.865	0.554	−0.05	+0.18	+0.17	1.08	
19	"	12.11	0.13	+0.01	−1.30	1.48	0.214	0.873	0.549	0.88	−0.65	−0.66	1.08	
20	"	12.16	0.07	+0.01	−0.57	0.75	0.208	0.881	0.544	−0.35	−0.13	−0.14	1.08	
21	"	. .	. .	. .	+0.11	3.72	. .	. .	. .	. .	. .	. .	. .	
22	"	11.13	0.10	−0.12	1.05	2.52	0.196	0.896	0.535	+0.81	+1.02	+1.01	1.08	R4 S4 R3 S3
23	"	11	0.09	0.04	+0.57	2.11	0.189	0.903	0.531	0.30	0.51	0.50	1.08	R3 S4
28	"	11.12	0.16	0.01	−0.29	2.08	0.158	0.934	0.512	+0.10	0.31	0.30	1.08	
31	"	11.12	0.10	−0.07	−0.31	1.34	0.138	0.949	0.501	−0.08	0.13	0.12	1.11	
June 1	"	11.12	0.15	+0.03	+0.30	3.12	0.132	0.954	0.499	+0.09	+0.29	+0.29	1.69	
2	"	12.13	0.21	+0.06	−0.15	3.31	0.125	0.958	0.496	−0.27	−0.07	−0.07	1.69	R3 S3
12	K	. .	. .	. .	1.73	2.02	. .	. .	. .	. .	. .	. .	. .	R2-3 S2-3
16	W	12.11	0.09	−0.20	1.15	2.33	0.034	0.997	0.471	1.07	0.88	0.86	1.69	
17	"	4.11	0.10	0.09	1.81	1.66	+0.030	0.997	0.470	1.73	1.54	1.52	1.69	
25	"	12.14	0.21	0.02	−0.15	2.66	−0.026	0.998	0.470	−0.72	−0.53	−0.50	1.69	
26	"	12.13	0.22	−0.10	+1.14	4.07	0.033	0.997	0.471	+0.55	+0.74	+0.77	1.69	
27	K	11.6	0.14	+0.03	−0.86	0.41	0.040	0.996	0.472	−0.89	−0.70	−0.67	2.40	Limb indist. R4 S4
29	W	9	0.18	. .	−2.50	−1.57	−0.053	+0.993	+0.474	−2.59	−2.40	−2.37	1.69	
30	"	8	−0.16	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	

1886		O	No. of Threads	$\Delta\alpha$ O—C	Merid. Pass. O—C	$\Delta\delta$ O—C	Vert. Diam. O—C	A	B	C	N	N′	N″	Wt.	Remarks
				s	s	″	″				″	″	″		
July	1	W	12.13	−0.14	−0.12	−0.48	−1.27	−0.066	+0.989	+0.476	−1.09	−0.87	−0.84	1.69	R 4 S 4
	2	"	12	0.11	0.16	+0.63	6.25	0.073	0.987	0.478	+0.04	+0.25	+0.28	1.69	
	3	"	12.13	0.17	0.06	−0.79	0.19	0.079	0.984	0.479	−0.93	−0.71	−0.68	1.69	R 4 S 4
	4	"	11.13	0.13	0.23	−0.85	2.13	0.086	0.981	0.481	0.96	0.74	0.71	1.69	R 3 S 3
	5	"	12.14	0.18	0.11	+0.26	−2.58	0.093	0.978	0.483	0.46	0.24	0.21	1.69	
	6	"	12.13	0.12	0.08	−1.05	+1.28	0.099	0.974	0.486	1.53	1.31	1.28	1.69	
	7	"	11.6	0.03	0.08	0.77	−2.77	0.105	0.971	0.488	0.75	0.53	0.50	1.69	
	10	"	10.11	0.12	0.12	−0.12	+0.49	0.124	0.959	0.495	−0.28	−0.05	−0.02	1.69	
	11	"	8.9	0.10	0.05	+1.47	−1.84	0.131	0.955	0.498	+0.81	+1.03	+1.06	1.69	
	12	"	12	0.17	0.15	+0.99	1.96	0.137	0.950	0.503	+0.18	+0.40	+0.43	1.64	
	17	"	12	0.16	0.11	−0.58	0.87	0.169	0.923	0.518	−0.91	−0.68	−0.66	1.64	
	18	"	12	0.11	0.04	−0.63	1.78	0.175	0.917	0.522	−0.84	−0.61	−0.59	1.64	
	19	"	5.12	0.07	0.11	+2.48	0.88	0.182	0.911	0.526	+1.84	+2.07	+2.09	1.64	R 4 S 3
	20	"	12.11	0.16	0.08	0.88	1.80	0.188	0.904	0.530	−0.02	+0.21	0.22	1.64	
	22	"	11.12	0.14	0.00	+0.21	2.17	0.201	0.890	0.539	0.12	+0.11	+0.12	1.64	
	25	"	11	0.27	0.10	−1.07	−1.09	0.219	0.867	0.553	1.88	−1.64	−1.63	1.49	
	29	"	10.12	0.09	0.09	+0.24	+0.46	0.243	0.833	0.574	0.53	0.27	0.26	1.64	R 4 S 4
	30	"	11	0.17	0.07	0.61	−2.85	0.248	0.824	0.580	−0.47	−0.21	−0.20	1.64	
Aug.	1	"	7.6	0.07	−0.01	+0.33	−1.57	0.260	0.805	0.591	+0.16	+0 42	+0.44	1.59	R3–4 S 3
	3	"	11.12	−0.14	+0.11	−2.27	+0.05	0.271	0.786	0.603	−2.74	−2.46	−2.44	1.59	
	4	"	11	+0.02	−0.06	+0.72	−2.29	0.277	0.775	0.610	+0.37	+0.65	+0.67	1.36	
	5	"	12	−0.17	0.11	+0.88	4.92	0.282	0.764	0.616	−0.26	+0.02	+0.04	1.59	
	6	"	7.2	0.15	−0.15	−2.27	1.52	0.287	0.753	0.623	2.82	−2.53	−2.51	1.59	R 4 S 2
	8	"	10.12	0.14	+0.02	−0.16	2.00	0.299	0.730	0.636	−0.69	−0.40	−0.38	1.59	R 4 S 3
	9	K	11.10	0.17	0.21	+1.23	1.54	0.305	0.719	0.644	+0.03	+0.32	+0.35	2.11	
	10	"	10.9	0.21	0.03	−0.41	−0.87	0.309	0.707	0.651	−1.80	−1.51	−1.48	2.11	R 4 S 4
	12	"	11.8	0.09	+0.17	2.68	+2.20	0.319	0.682	0.666	3.00	2.69	2.66	2.00	R 4–5 S 4–5
	13	"	11.10	0.16	−0.03	0.12	−0.39	0.325	0.669	0.673	0.80	0.50	0.47	2.00	R 4 S 4
	15	"	11.2	0.23	+0.01	−2.57	+0.06	0.334	0.644	0.689	4.13	3.82	3.78	2.00	Very unsafe. Thro' clouds
	16	"	11.8	0.15	0.03	+0.02	+0.29	0.339	0.630	0.697	1.15	0.84	0.80	2.00	R 3–4 S 4–5
	21	"	11.10	0.14	0.07	−1.45	−2.12	0.361	0.560	0.740	2.11	1.77	1.73	1.64	R 2–3 S 2–3
	22	"	10.5	0.24	0.18	−0.11	+1.39	0.365	0.546	0.749	1.33	0.99	0.94	1.89	
	23	"	11.6	0.22	0.09	+0.37	−1.13	0.369	0.531	0.759	1.25	0.91	0.86	1.80	R 3 S 4–5
	27	"	11.6	0.16	0.03	+0.49	−0.84	0.384	0.470	0.797	0.83	0.47	0.38	1.89	Through fog. R 3–4 S 3
	28	"	11.9	0.20	0.02	−1.54	+0.08	0.388	0.454	0.807	2.60	2.24	2.14	2.00	R 4 S 4
	29	"	10	0.24	0.13	1.40	+0.76	0.391	0.438	0.818	2.71	2.35	2.24	1.89	R 4 S 3
	30	"	10.8	0.17	0.14	1.08	−1.37	0.394	0.421	0.828	1.98	1.61	1.49	1.89	
	31	"	4.10	0.14	+0.07	−1.85	+1.22	0.398	0.405	0.839	2.58	2.20	2.08	1.89	R 3 S 4
Sept.	1	"	8	0.23	. .	+0.73	−0.92	0.401	0.388	0.850	−1.04	−0.68	−0.55	1.33	R 3 S 3–4
	2	"	12.9	0.15	0.00	+1.43	1.11	0.403	0.371	0.861	+0.13	+0.49	+0.63	1.13	Scarcely observable on account of mist and undulations
	6	"	6.5	0.21	−0.05	−0.54	0.20	0.414	0.303	0.907	−2.22	−1.83	−1.67	1.24	
	7	"	12.9	0.34	+0.09	+1.01	1.57	0.416	0.285	0.918	1.59	1.10	0.93	0.69	
	9	"	10	0.17	0.03	+0.37	−0.25	0.420	0.250	0.943	1.07	0.67	0.49	1.24	R 2 S 2–3
	11	"	12.9	0.29	0.02	−0.81	+1.11	0.424	0.215	0.969	2.64	2.22	2.04	0.68	
	12	"	12.7	0.34	+0.10	−1.23	+2.36	0.425	0.196	0.982	3.38	−2.96	−2.77	1.20	R 4–5 S 5
	13	W	12	0.12	−0.07	+0.41	−3.13	0.427	0.178	0.995	0.20	+0.23	+0.42	0.74	
	14	"	11.12	0.09	−0.16	−1.09	+0.87	0.429	0.160	1.008	1.50	−1.07	−0.88	0.74	
	15	"	12.13	0.06	+0.04	−0.66	−2.86	0.429	0.152	1.022	1.02	0.58	−0.38	0.73	R 4 S 3
	17	"	12	0.15	0.07	+0.30	1.72	0.431	0.106	1.050	0.64	0.17	+0.03	0.73	R 4 S 4
	18	"	12	0.19	0.00	−2.77	−3.82	0.431	0.087	1.064	3.83	3.36	−3.15	0.73	
	19	"	12.16	0.28	0.31	2.76	+1.86	0.432	+0.068	1.079	4.40	3.92	3.71	0.69	
	24	"	11.12	0.25	0.05	3.09	+0.96	0.434	−0.025	1.155	4.67	4.16	3.94	0.82	R 3 S 4
	25	"	12.15	0.17	0.07	0.62	−1.59	0.433	0.044	1.171	1.67	1.15	0.94	0.82	R 3 S 3
	27	K	5.10	0.19	0.03	0.31	1.58	0.432	0.081	1.204	1.35	0.82	−0.61	1.16	R 2–3 S 3
	29	"	11	0.13	+0.07	−0.04	1.55	0.430	0.119	1.240	0.68	−0.14	+0.06	1.24	R 2–3 S 3
	30	W	12.11	0.13	−0.10	+0.44	0.68	0.430	0.137	1.262	0.34	+0.20	+0.40	0.83	
Oct.	1	"	12	0.17	+0.14	−0.26	1.88	0.429	0.156	1.272	1.29	−0.75	−0.56	0.83	R 4 S 4
	2	"	12.15	0.15	−0.20	0.16	4.34	0.427	0.174	1.290	0.92	0.38	0.19	0.73	
	3	"	11.13	0.22	+0.01	0.11	4.84	0.426	0.192	1.309	1.32	0.77	0.58	0.70	
	4	K	12.13	−0.19	+0.06	−2.57	−1.44	−0.424	−0.210	+1.328	−3.71	−3.15	−2.97	1.24	

1886–7		O	No. of Threads	$\Delta\alpha$ O—C	Merid. Pass. O—C	$\Delta\delta$ O—C	Vert. Diam. O—C	A	B	C	N	N′	N″	Wt.	Remarks
				s	s	″	″				″	″	″		
Oct.	8	W	12	−0.10	−0.12	+0.05	−5.73	−0.417	−0.282	+1.404	−0.50	+0.11	+0.27	0.83	
	20	K	12.13	0.14	0.25	−0.94	3.18	0.380	0.488	1.664	1.52	−0.81	−0.72	1.00	R 2 S 4
	25	W	12	0.24	0.14	0.68	3.78	0.360	0.554	1.786	1.75	0.97	0.91	0.87	R 4 S 4
	26	"	11	0.27	. .	1.90	4.13	0.353	0.564	1.812	3.23	2.45	2.40	0.87	R 4 S 4
	28	"	9	0.46	. .	1.57	2.76	0.346	0.607	1.862	3.85	3.04	2.99	0.87	R 3 S 4
Nov.	16	"	12	0.16	0.04	1.16	4.86	0.241	0.835	2.410	−1.51	−0.57	−0.67	0.86	R 4 S 4
	18	"	12	0.00	. .	0.05	. .	0.228	0.854	2.459	+0.18	+1.16	+1.04	0.93	R 4 S 4
	20	"	12	0.07	−0.18	−0.54	1.49	0.216	0.871	2.517	−0.54	0.48	0.34	0.93	R 4 S 4
	24	"	12.1	0.20	+0.07	+0.24	0.35	0.190	0.902	2.630	0.21	+0.87	+0.71	0.97	R 5 S 5
	28	"	12	0.11	−0.13	−1.63	0.50	0.163	0.929	2.738	−1.78	−0.67	−0.86	0.95	
Dec.	12	"	11.15	0.03	0.12	0.10	2.40	0.067	0.989	3.021	+0.10	+1.27	+1.02	0.97	R 4 S 4
	17	"	12.8	0.05	0.25	−1.04	−2.93	−0.031	0.997	3.072	−0.84	0.37	0.12	0.97	Through clouds. R 4 S 4
1887	26	"	12	0.42	0.45	+1.06	+4.76	+0.033	0.997	3.067	+1.37	+2.59	+2.34	0.95	Through mist and clouds
Jan.	7	K	11.5	−0.16	0.05	−1.71	−4.79	0.116	0.964	2.902	−1.33	−0.20	−0.49	0.80	Very unsafe. [R 4 S 4
	8	W	2.10	+0.07	0.42	0.43	5.46	0.124	0.960	2.877	0.35	+0.78	+0.48	0.95	Scarcely observable
	10	"	4.13	−0.13	0.16	−1.18	2.21	0.137	0.950	2.832	−0.70	0.44	0.17	0.95	R 3 S 3 [Through clouds
	15	"	11.12	0.18	0.16	+0.21	0.46	0.171	0.921	2.706	+0.76	1.89	1.68	0.93	R 4 S 4
	25	"	12.13	0.16	0.15	−0.75	2.56	0.237	0.842	2.420	−0.12	0.88	0.78	0.91	R 4 S 4
	26	"	12	0.08	0.09	0.99	4.25	0.243	0.833	2.391	0.51	0.49	0.40	0.91	
	28	K	12.11	0.23	−0.02	−1.74	2.88	0.255	0.813	2.331	−0.67	0.29	0.22	0.77	
	31	W	9.12	0.17	0.00	+1.25	2.28	0.273	0.781	2.243	+2.03	2.97	2.92	0.89	
Feb.	7	"	12.9	0.20	0.00	−0.02	2.47	0.313	0.698	2.041	+0.99	1.83	1.83	0.86	R 4 S 4
	10	"	12.11	0.16	+0.01	1.03	−2.48	0.329	0.658	1.957	−0.06	0.75	0.77	0.85	
	11	"	11.12	0.27	0.05	1.52	+0.23	0.334	0.644	1.931	+0.01	0.80	0.82	0.86	
	15	"	11	0.20	0.11	0.10	+1.59	0.351	0.594	1.824	1.00	1.75	1.78	0.82	
	16	"	12.10	0.26	0.12	1.14	−0.52	0.358	0.571	1.798	+0.31	1.06	1.09	0.83	R 5 S 4
	17	"	11	0.22	. .	2.04	+1.04	0.362	0.556	1.772	−0.68	+0.07	+0.11	0.83	R 4 S 4
	18	"	12.11	0.28	+0.23	−5.91	+3.64	0.366	0.542	1.747	−4.20	−3.47	−3.43	0.82	
	23	"	12.11	0.15	−0.07	+0.10	−2.05	0.386	0.462	1.627	+1.00	+1.66	+1.73	0.78	
	24	"	12	0.08	−0.04	−0.81	−3.89	0.390	0.445	1.603	−0.31	0.34	0.42	0.82	R 2–3 S 3
	26	K	11	−0.22	+0.20	1.69	+0.82	0.393	0.411	1.559	0.22	+0.41	+0.50	0.69	R 4 S 4–5
	27	"	12.11	+0.16	0.15	2.07	+0.13	0.400	0.394	1.536	2.01	−1.38	−1.29	0.72	R 4–5 S 4–5
	28	"	11	−0.16	0.19	1.28	−0.88	0.403	0.377	1.514	1.15	0.53	0.43	0.74	R 4 S 4
Mar.	1	"	12.11	0.28	+0.13	2.95	+2.14	0.406	0.358	1.493	−1.21	−0.59	−0.49	1.03	R 4 S 4–5
	2	W	11	−0.30	. .	0.14	−0.52	0.408	0.341	1.472	+1.86	+2.47	+2.58	1.01	R 2 S 2
	15	"	12.5	+0.01	−0.11	1.40	4.26	0.431	0.103	1.223	−1.32	−0.82	−0.67	0.93	R 4 S 4
	18	"	6.11	+0.01	0.11	1.06	−5.72	0.433	0.047	1.173	1.12	−0.64	−0.49	0.74	R 4 S 4
	19	"	12.2	−0.20	0.00	1.44	+3.27	0.433	−0.027	1.157	−0.14	+0.34	+0.49	0.93	R 3–4 S 3–4
	30	"	12.9	0.11	0.01	0.51	−2.01	0.427	+0.179	0.988	+0.32	+0.72	0.87	0.93	R 4 S 4
	31	"	12.8	0.21	0.15	2.01	3.78	0.426	0.197	0.981	−0.54	−0.14	+0.01	0.93	R 4 S 4
Apr.	2	"	12	0.21	0.10	−2.13	3.24	0.422	0.233	0.955	−0.81	−0.44	−0.28	0.93	R 4 S 4
	3	"	12.11	0.19	−0.16	+0.30	−3.13	0.420	0.251	0.942	+1.49	+1.86	+2.02	0.93	Misty. R 4 S 4
	4	"	12	0.01	+0.04	−1.73	+0.23	0.418	0.268	0.930	−1.54	−1.17	−1.01	0.99	R 3–4 S 3
	5	"	12.11	0.18	−0.12	−4.43	+2.48	0.416	0.286	0.917	−3.19	−2.84	−2.68	0.87	
	7	"	9.11	0.17	0.04	+0.15	−2.64	0.411	0.322	0.893	+1.18	+1.52	+1.68	0.83	R 3–4 S 2–3
	9	"	12.15	0.20	0.11	−0.60	3.23	0.406	0.357	0.870	0.60	0.94	1.09	0.99	R 3 S 3
	10	"	12.13	0.23	0.12	0.46	2.28	0.403	0.374	0.859	+1.05	+1.39	+1.53	0.99	R 4 S 4
	15	"	9	−0.01	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	
	17	"	12	+0.02	. .	1.35	0.00	0.380	0.488	0.785	−1.13	−0.81	−0.70	1.01	
	18	"	1.9	−0.06	0.23	1.18	3.81	0.376	0.504	0.775	0.87	0.56	0.45	0.97	
	20	"	1.13	0.10	0.09	1.41	3.51	0.368	0.535	0.756	−1.38	−1.09	−0.99	1.01	
	21	"	12	0.16	0.09	0.32	−1.89	0.364	0.549	0.747	+0.66	+0.95	+1.05	1.01	R 2 S 2
	22	"	12	0.26	. .	3.84	+1.92	0.360	0.564	0.738	−2.33	−2.04	−1.95	1.01	
	23	"	12.13	0.21	0.05	1.87	−2.97	0.355	0.578	0.728	0.79	0.51	0.43	1.03	
	24	"	7.13	0.18	0.10	−1.56	3.99	0.351	0.593	0.720	−0.66	−0.38	−0.30	0.87	
	25	"	18	0.06	. .	+0.76	1.54	0.347	0.607	0.711	+1.17	+1.45	+1.52	0.89	
	29	"	7	0.14	0.11	−0.54	−2.68	0.328	0.661	0.678	+0.25	+0.52	+0.59	1.03	Blue 4
May	2	K	12.11	0.15	0.02	3.06	+0.12	0.312	0.699	0.655	−2.26	−1.99	−1.94	1.06	Cirri
	4	"	12.11	0.05	0.00	−1.79	−0.95	0.301	0.723	0.649	−1.46	−1.19	−1.17	1.09	R 3 S 3 [observable
	5	"	12.11	−0.13	−0.01	+1.58	−0.67	+0.295	+0.735	+0.633	+2.10	+2.36	+2.38	1.09	Very undul. Scarcely

1887		O	No. of Threads	$\Delta\alpha$ O—C	Merid. Pass. O—C	$\Delta\delta$ O—C	Vert. Diam. O—C	A	B	C	N	N′	N″	Wt.	Remarks
				s	s	″	″				″	″	″		
May	9	K	6	−0.17	+0.03	+1.46	−2.28	+0.275	+0.779	+0.607	+2.13	+2.39	+2.40	1.13	Through clouds
	26	W	12	0.13	−0.14	−0.15	3.15	0.172	0.920	0.520	0.27	0.48	0.47	1.03	
	27	"	7.13	0.11	0.09	+0.27	0.45	0.166	0.927	0.516	+0.62	0.83	0.82	1.03	
	28	"	12	−0.16	−0.15	−0.41	−4.60	0.159	0.933	0.512	−0.10	+0.11	+0.10	1.08	
	29	"	11	+0.08	+0.10	1.47	+1.73	0.153	0.938	0.509	1.72	−1.51	−1.52	1.08	R4 S4
	31	"	12	−0.20	+0.03	0.67	−2.10	0.140	0.948	0.502	0.17	+0.03	+0.02	1.08	
June	1	"	1.12	0.12	−0.08	−0.51	3.38	0.133	0.953	0.499	−0.19	0.01	0.00	1.59	R2 S2
	2	"	11.12	0.08	−0.20	+0.40	−3.17	0.126	0.957	0.496	+0.48	+0.68	+0.67	1.59	R2 S2
	6	K	11.12	0.18	+0.12	−0.75	+0.55	0.101	0.973	0.487	−0.55	−0.35	−0.35	2.41	R2 S4
	7	"	12.11	0.14	+0.15	2.32	−0.58	0.095	0.977	0.484	2.04	1.84	1.84	2.41	R3 S3-4
	8	"	9	0.10	−0.01	−1.98	1.79	0.088	0.980	0.482	−1.77	−1.58	−1.58	2.41	Through clouds
	9	"	11	0.14	. .	+1.02	1.13	0.082	0.983	0.480	+2.66	+2.85	+2.85	2.41	Through clouds
	10	"	. .	. .	. .	−0.03	0.76	. .	. .	. .	. .	. .	. .	. .	
	11	"	12.11	0.06	+0.01	+0.09	3.08	0.069	0.988	0.477	+0.08	+0.28	+0.29	2.41	
	13	"	12	0.06	+0.11	−1.96	0.69	0.055	0.992	0.474	−1.83	−1.64	−1.63	2.41	
	14	W	5	0.24	. .	1.56	1.56	0.048	0.994	0.473	1.46	1.27	1.26	1.69	R3 S3
	15	"	7.16	0.17	−0.06	0.31	2.78	0.042	0.995	0.472	0.27	0.08	0.07	1.69	
	16	"	4.15	0.07	0.17	0.59	3.64	0.035	0.996	0.471	0.61	0.42	0.40	1.69	
	17	"	12.11	0.21	−0.07	1.13	1.66	0.029	0.997	0.471	0.96	−0.77	−0.75	1.69	
	18	"	12.18	0.20	+0.07	0.34	2.19	0.022	0.998	0.470	0.20	+0.13	+0.15	1.69	
	19	"	12.11	0.09	−0.13	0.76	3.04	0.015	0.999	0.470	0.81	−0.62	−0.60	1.69	
	20	"	12.15	0.17	0.12	0.28	2.84	+0.013	0.999	0.469	0.32	0.13	0.10	1.69	
	22	"	10.15	0.12	0.15	0.71	2.80	−0.005	1.000	0.469	0.64	0.45	0.42	1.69	
	23	"	12	0.10	−0.02	0.77	0.90	0.011	0.999	0.470	0.71	0.52	0.49	1.69	
	24	"	6.13	0.20	+0.05	1.06	3.06	0.018	0.999	0.470	1.18	0.99	0.96	1.69	
	25	"	12.14	0.22	−0.11	−0.68	−3.09	0.025	0.998	0.470	−0.83	−0.64	−0.61	1.69	
	26	"	12.11	0.25	+0.01	+0.59	+3.15	0.031	0.997	0.471	+0.55	+0.74	+0.77	1.69	
	27	"	12	0.13	−0.08	+0.02	−1.45	0.037	0.996	0.472	+0.03	+0.22	+0.25	1.69	
	30	"	12.13	0.28	−0.12	−0.43	2.30	0.058	0.992	0.475	−0.74	−0.54	−0.51	1.69	
July	1	"	12.13	0.23	+0.18	+0.28	2.55	0.065	0.990	0.476	−0.01	+0.20	+0.23	1.69	
	2	"	12.13	0.17	−0.02	+0.31	3.69	0.071	0.988	0.477	+0.21	+0.42	+0.45	1.69	
	3	"	11.13	0.23	−0.06	−0.42	1.03	0.078	0.985	0.479	−0.61	−0.40	−0.37	1.69	
	4	"	12.13	0.10	+0.18	0.42	2.72	0.084	0.982	0.481	0.62	0.41	0.38	1.69	R4 S4
	12	"	12	0.17	+0.07	2.39	2.47	0.136	0.951	0.499	2.81	2.59	2.57	1.64	R4 S4
	13	"	11	0.20	. .	1.07	1.24	0.142	0.947	0.504	1.42	1.20	1.18	1.69	
	14	"	10.18	0.17	−0.09	1.35	4.07	0.149	0.941	0.507	1.65	1.43	1.41	1.69	
	15	"	12.18	0.23	0.09	1.09	2.34	0.155	0.936	0.510	1.70	1.48	1.47	1.64	
	20	"	12.13	0.14	0.27	0.29	2.07	0.187	0.906	0.529	0.75	0.52	0.51	1.54	
	21	"	12.13	0.14	0.15	0.44	3.62	0.192	0.899	0.534	0.76	0.53	0.52	1.64	R2 S4
	23	"	12.14	0.11	−0.07	−0.58	−2.32	0.205	0.885	0.543	0.83	0.59	0.58	1.59	
	24	"	12.11	0.27	+0.01	0.00	+0.47	0.211	0.877	0.547	−0.93	−0.69	−0.68	1.59	
	25	"	12.13	0.14	−0.18	+0.70	−4.32	0.218	0.868	0.552	+0.17	+0.41	+0.42	1.59	
	28	"	12.11	0.17	+0.11	−0.75	1.24	0.235	0.844	0.567	−1.26	−1.01	−1.00	1.59	
	29	"	12.16	0.25	+0.02	+1.59	0.13	0.241	0.835	0.573	+0.77	+1.02	+1.03	1.64	
	30	"	5	0.12	. .	1.57	−1.80	0.247	0.826	0.578	1.05	1.30	1.31	1.59	
Aug.	1	"	12	0.11	. .	+0.89	+0.60	0.259	0.807	0.590	+0.39	+0.65	+0.67	1.32	
	2	"	6.11	0.16	−0.25	−0.44	−2.89	0.264	0.798	0.596	−0.95	−0.68	−0.66	1.59	
	3	"	12	0.17	+0.01	+0.63	+2.04	0.270	0.788	0.602	+0.03	+0.31	+0.33	1.54	
	4	"	12	0.08	−0.06	−0.22	−2.42	0.275	0.777	0.608	−0.62	−0.34	−0.32	1.59	
	5	"	11.12	0.19	0.06	−0.18	0.85	0.281	0.766	0.614	1.05	−0.77	−0.75	1.59	
	6	"	12	0.15	0.09	+0.31	−3.92	0.286	0.755	0.621	−0.25	+0.03	+0.05	1.54	
	8	"	12	0.11	0.01	+0.82	+0.15	0.297	0.733	0.635	+0.42	+0.70	+0.72	1.59	R4 S4
	9	"	12.14	0.28	−0.03	−0.55	+1.11	0.303	0.721	0.642	−1.88	−1.59	−1.57	1.54	
	11	"	14	0.25	. .	1.15	−2.22	0.313	0.697	0.656	2.38	2.08	2.05	1.49	
	12	"	12	0.13	+0.07	0.26	+0.46	0.318	0.685	0.667	0.79	0.49	0.46	1.54	R4 S4
	15	"	12	−0.22	. .	2.72	−2.96	0.333	0.647	0.687	−3.73	−3.42	−3.38	1.54	R2 S2
	22	"	12.18	+0.11	−0.05	−0.48	+0.46	0.363	0.549	0.747	+0.06	+0.40	+0.45	0.97	R4 S2
	23	"	2.13	+0.01	−0.17	+0.51	−2.13	0.368	0.534	0.756	0.51	0.85	0.91	0.97	
	24	"	10	−0.16	. .	+1.81	2.95	0.372	0.520	0.765	+1.01	+1.36	+1.43	1.54	R4 S3
	25	"	12.11	0.20	+0.03	−0.59	1.16	0.376	0.505	0.775	−1.63	−1.28	−1.20	1.54	
	26	"	11.13	0.05	−0.04	+0.31	3.40	0.379	0.490	0.785	−0.04	+0.31	+0.40	1.44	
	28	K	3	−0.24	. .	+1.50	−1.47	−0.387	+0.459	+0.805	+0.06	+0.42	+0.52	1.13	

1887–88	O	No. of Threads	$\Delta\alpha$ O—C	Merid. Pass. O—C	$\Delta\delta$ O—C	Vert. Diam. O—C	A	B	C	N	N′	N″	Wt.	Remarks
			s	s	″	″				″	″	″		
Aug. 29	K	6	−0.10	+0.02	+0.39	−1.03	−0.390	+0.442	+0.815	−0.25	+0.12	+0.23	1.80	Through clouds
30	"	12.10	0.11	−0.02	−1.71	2.28	0.394	0.425	0.826	2.27	−1.90	−1.78	1.13	
31	"	3	0.09	. .	0.72	0.10	0.397	0.409	0.836	1.17	0.80	0.67	1.80	
Sept. 1	"	8.10	0.11	0.00	−1.65	0.03	0.400	0.393	0.847	2.22	−1.86	−1.73	1.24	Clouds. R4 S4
3	"	12.10	0.14	0.00	+0.79	2.64	0.406	0.358	0.869	0.11	+0.27	+0.42	1.13	Blue 4–5
9	"	9.11	0.09	+0.04	−0.16	2.43	0.420	0.304	0.940	0.78	−0.37	−0.19	1.20	
13	"	12.8	0.02	−0.15	1.57	−1.47	0.427	0.183	0.991	1.60	1.17	0.97	0.68	
14	"	5	0.02	. .	1.36	+0.25	0.428	0.165	1.003	1.39	0.95	0.75	1.20	
15	"	12.10	0.20	+0.27	1.38	+0.61	0.429	0.147	1.018	2.57	2.12	1.92	1.24	R4–5 S4–5
16	"	12	0.20	−0.04	−2.76	−1.28	0.430	0.129	1.032	−3.95	−3.49	−3.28	1.20	R3 S4
17	"	12	0.15	−0.09	+1.16	2.83	0.431	0.109	1.046	+0.25	+0.61	+0.82	1.09	
18	"	12.11	0.17	+0.10	−0.77	2.76	0.431	0.092	1.061	−1.91	−1.45	−1.24	1.09	
21	"	12.11	0.19	0.02	+0.49	0.82	0.433	0.036	1.105	0.78	−0.29	−0.07	1.16	
22	"	10.2	0.15	+0.21	+0.89	−0.31	0.434	0.017	1.120	0.13	+0.37	+0.59	1.24	R4–5 S4–5
23	"	12.6	0.17	−0.04	−1.58	+0.80	0.434	−0.002	1.135	2.59	−2.09	−1.87	1.20	R4 S4–5
25	"	12.11	0.14	+0.13	−1.11	−0.96	0.433	0.039	1.167	1.92	−1.40	−1.19	1.20	R3 S3
26	"	12.7	0.11	0.18	+0.48	+1.09	0.433	0.058	1.183	0.27	+0.26	+0.46	1.20	R5 S5
27	W	12.11	0.14	0.04	+0.16	+1.46	0.432	0.077	1.200	0.79	−0.26	−0.06	1.29	
Oct. 4	"	. .	. .	. .	−0.40	−2.72	. .	. .	. .	. .	. .	. .	. .	
16	"	13.12	0.14	+0.21	2.21	+3.48	0.395	0.417	1.567	2.94	2.24	2.13	0.63	
20	"	5	0.05	. .	3.12	−1.89	0.381	0.484	1.658	3.31	2.57	2.48	0.65	
22	"	12	0.29	−0.01	0.83	1.76	0.373	0.515	1.706	2.42	1.66	1.59	0.86	
23	"	12.11	0.27	+0.03	1.29	1.11	0.369	0.530	1.730	2.81	2.04	1.97	0.86	R3 S3
26	"	10.13	0.29	−0.01	0.85	−1.91	0.357	0.575	1.805	2.30	1.48	1.43	0.87	R4 S4
27	"	11.12	0.34	+0.27	1.13	+0.70	0.352	0.690	1.830	2.82	1.99	1.95	0.87	R5 S5
28	"	12	0.02	−0.21	0.45	−3.75	0.347	0.604	1.856	1.51	0.68	0.65	0.68	
Nov. 1	"	12	0.32	0.04	1.33	1.66	0.328	0.660	1.963	2.91	2.14	2.13	0.86	
2	"	12.17	0.23	0.02	−1.45	1.70	0.323	0.674	1.990	2.46	−1.69	−1.69	0.87	
13	"	12.16	0.25	−0.02	+0.76	1.01	0.261	0.803	2.305	0.13	+0.80	+0.72	0.91	R4 S3
16	"	12.14	0.30	+0.03	−1.03	3.01	0.242	0.832	2.393	2.14	−1.15	−1.25	0.91	R4 S4
17	"	1.12	0.44	+0.44	−0.53	1.87	0.236	0.843	2.422	2.11	−1.11	−1.22	0.91	
26	"	11	0.28	. .	+0.43	2.07	0.177	0.914	2.679	0.17	+0.90	+0.76	0.95	
Dec. 11	"	12.17	0.14	−0.08	−0.27	−2.16	−0.076	0.986	3.003	0.34	+0.87	+0.63	0.93	
23	"	?	0.28	+0.19	1.47	+1.66	+0.010	0.999	3.084	1.45	−0.19	−0.45	0.95	R4 S4
26	"	12	0.19	. .	−1.50	−3.89	0.031	0.997	3.072	−1.44	−0.17	−0.43	0.95	
27	"	2.11	0.25	0.15	+0.56	+1.02	0.038	0.996	3.063	+0.79	+2.08	+1.81	0.95	
29	"	12.8	0.22	0.07	−2.04	−3.60	0.052	0.993	3.045	−1.78	−0.48	−0.75	0.95	R4 S4
1888 Jan. 31	"	12	0.23	+0.04	0.61	+0.95	0.068	0.989	3.024	0.40	+0.86	+0.58	0.95	
Jan. 5	"	12.13	0.10	−0.08	1.46	−3.68	0.103	0.973	2.946	1.33	−0.13	−0.43	0.95	R4 S4
13	"	12	0.23	+0.33	1.50	1.59	0.156	0.935	2.765	0.86	+0.28	+0.04	0.93	
14	"	12.11	0.11	−0.09	3.09	−1.25	0.163	0.928	2.738	2.72	−1.58	−1.80	0.93	
15	"	12	0.18	+0.02	2.65	+1.60	0.170	0.922	2.713	2.20	−1.08	−1.29	0.93	R4 S4
16	"	12.13	0.21	+0.12	0.91	−1.14	0.176	0.916	2.684	0.36	+0.76	+0.56	0.93	
25	"	12	0.20	−0.04	3.06	1.47	0.235	0.844	2.428	−2.25	−1.24	−1.34	0.91	R3 S1–2
28	"	12.13	0.17	0.06	0.72	1.59	0.254	0.816	2.339	+0.03	+0.98	+0.91	0.85	R2–3 S2–3
29	"	12.5	0.10	−0.04	2.04	1.80	0.260	0.805	2.309	−1.65	−0.70	−0.77	0.89	R2–3 S2–3
30	"	12.15	0.37	+0.31	2.37	. .	0.266	0.795	2.280	0.89	+0.06	0.00	0.89	R3 S3
Feb. 13	"	12	0.14	−0.02	2.28	2.35	0.343	0.619	1.883	1.45	−0.69	0.66	0.86	Through clouds
14	"	7.6	−0.16	0.07	2.33	3.70	0.347	0.604	1.856	−1.39	−0.64	−0.61	0.85	
28	"	8	+0.11	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	
Mar. 2	"	12	−0.10	0.05	0.53	1.36	0.410	0.328	1.455	+0.09	+0.69	+0.84	0.93	
4	"	12.10	0.10	−0.02	−0.10	5.25	0.415	0.292	1.414	0.52	1.10	1.25	0.68	
8	"	12.10	0.11	+0.01	+0.82	0.01	0.424	0.219	1.336	1.65	2.18	2.33	0.99	
15	"	12	0.23	0.01	−1.20	−2.51	0.431	−0.089	1.210	2.55	3.02	3.17	0.65	R2 S2
21	"	12.10	0.06	+0.02	0.34	+0.08	0.434	+0.025	1.113	+0.07	+0.52	+0.67	0.97	
23	"	12	0.17	−0.05	0.06	−0.23	0.433	0.063	1.082	−1.14	−0.71	−0.56	0.97	
April 8	"	7.9	0.18	+0.16	−2.55	2.05	0.407	0.352	0.873	−3.48	−3.13	−2.97	0.85	R4 S3
9	"	11	0.02	. .	+0.01	1.60	0.404	0.374	0.862	+0.30	+0.64	+0.80	0.85	
16	"	7.12	0.10	0.21	−2.08	0.48	0.380	0.485	0.787	−1.47	−1.17	−1.01	0.85	
24	"	12.11	0.20	0.03	0.06	2.52	0.347	0.604	0.713	+1.02	+1.30	+1.46	0.86	
27	"	12.7	0.22	+0.13	2.38	2.26	0.334	0.645	0.688	−1.09	−0.81	−0.65	0.66	
29	"	6	−0.10	. .	−1.42	−1.88	+0.324	+0.671	+0.672	−0.73	−0.46	−0.30	0.99	

APPENDIX II.

1883	P	E	F	G	$\Delta\alpha \cos\delta$	H	Wt.	J	K	L	$\Delta\delta$	M	Wt.
					″						″		
Jan. 23	+0.02	+1.01	+0.73	−1.80	−0.34	− 0.1	0.59	. .	. .	. .	. .	. .	. .
24	−1.55	1.00	0.75	1.79	−0.26	− 0.1	0.59	. .	. .	. .	. .	. .	. .
31	6.58	0.99	0.94	1.70	+2.39	+ 0.2	0.51	. .	. .	. .	. .	. .	. .
Feb. 5	3.10	0.99	1.09	1.58	−3.23	0.6	0.63	. .	. .	. .	. .	. .	. .
7	−0.39	0.98	1.13	1.56	0.71	0.7	0.54	. .	. .	. .	. .	. .	. .
10	+3.56	0.98	1.20	1.47	1.30	0.8	0.68	+0.37	+0.40	−0.49	+1.06	+0.3	0.94
12	5.34	0.97	1.25	1.43	2.20	0.9	0.63	. .	. .	. .	. .	. .	. .
14	5.37	0.97	1.29	1.39	1.38	1.0	0.51	. .	. .	. .	. .	. .	. .
20	+1.90	0.96	1.42	1.23	0.12	1.4	0.54	0.37	0.54	0.47	0.82	0.5	0.94
23	−1.81	0.96	1.49	1.16	1.89	1.7	0.56	0.38	0.58	0.46	1.27	0.7	0.94
24	2.93	0.96	1.50	1.13	0.17	1.8	0.52	0.39	0.61	0.46	0.92	0.7	0.94
27	5.50	0.96	1.56	1.05	0.11	2.2	0.68	0.39	0.63	0.43	0.90	0.9	0.94
Mar. 2	6.21	0.95	1.59	0.96	2.31	2.4	0.94	0.39	0.65	0.39	0.21	1.0	1.23
3	5.92	0.94	1.61	0.93	0.88	2.5	0.90	0.39	0.66	0.39	0.22	1.0	1.23
4	5.38	0.94	1.63	0.90	−0.23	2.6	0.90	0.39	0.67	0.39	1.12	1.1	1.23
7	−2.61	0.93	1.67	0.82	+2.07	2.9	0.69	. .	. .	. .	. .	. .	. .
17	+5.72	0.93	1.77	0.52	+1.17	4.0	0.65	. .	. .	. .	. .	. .	. .
19	4.56	0.93	1.78	0.45	−1.94	4.1	0.88	. .	. .	. .	. .	. .	. .
23	+0.43	0.93	1.81	0.33	1.46	4.6	0.89	0.40	0.79	0.14	1.75	2.0	1.23
26	−3.09	0.93	1.82	−0.23	−0.62	5.0	0.83	0.40	0.79	−0.10	0.18	2.2	1.23
April 26	−5.11	0.94	1.73	+0.74	+3.10	8.5	0.94	0.33	0.61	+0.26	+0.17	3.0	1.23
May 7	. .	. .	. .	. .	. .	. .	. .	0.26	0.45	0.30	−2.65	2.7	1.23
13	+6.36	0.95	1.47	1.23	−2.21	10.1	0.94	. .	. .	. .	. .	. .	. .
14	6.43	0.95	1.45	1.27	2.48	10.2	0.81	. .	. .	. .	. .	. .	. .
15	6.23	0.95	1.45	1.30	3.00	10.3	1.04	0.25	0.37	0.37	0.45	2.8	1.23
16	5.75	0.95	1.42	1.32	2.07	10.4	0.89	. .	. .	. .	. .	. .	. .
17	5.21	0.94	1.39	1.35	3.58	10.4	1.00	0.22	0.34	0.33	0.48	2.6	1.23
18	4.26	0.94	1.37	1.37	1.64	10.4	1.01	0.21	0.32	0.32	0.75	2.5	1.23
21	+0.83	0.94	1.30	1.43	1.95	10.6	0.74	0.20	0.28	0.32	1.64	2.3	1.23
22	−0.48	0.94	1.27	1.46	1.99	10.7	1.06	0.19	0.28	0.32	0.22	2.3	1.23
23	1.72	0.94	1.25	1.48	2.19	10.7	1.08	0.19	0.26	0.31	0.45	2.2	1.23
24	2.91	0.94	1.22	1.50	1.56	10.8	1.10	0.18	0.24	0.30	1.22	2.1	1.23
25	3.99	0.94	1.21	1.53	0.91	10.8	1.11	0.18	0.24	0.30	0.12	2.1	1.23
June 1	4.72	0.95	1.01	1.68	1.98	11 4	1.64	0.14	0.15	0.24	−0.90	1.6	1.43
2	. .	. .	. .	. .	. .	. .	. .	0.14	0.14	0.24	+0.57	1.6	1.43
4	−1.62	0.96	0.94	1.74	3.33	11.5	1.89	0.12	0.11	0.21	+0.32	1.4	1.43
14	+6.32	0.97	0.63	1.90	1.16	11.8	1.67	0.05	0.03	0.10	−0.35	0.6	1.43
15	+5.74	0.97	0.60	1.90	3.27	11.8	0.33	+0.05	+0.03	+0.10	−0.35	+0.6	1.43
24	−4.58	0.97	0.29	1.98	2.17	11.7	0.89	−0.02	−0.01	−0.04	+0.26	−0.2	1.43
25	5.37	0.97	0.27	1.98	3.93	11.7	1.52	0.03	0.01	0.06	0.65	0.4	1.43
28	6.02	0.97	0.16	1.99	0.25	11.6	1.70	0.05	0.01	0.10	+0.44	0.6	1.43
29	5.69	0.97	+0.13	1.99	0.60	11.6	1.67	0.05	−0.01	0.10	−0.01	0.6	1.43
July 3	1.57	0.97	−0.01	2.00	2.69	11.5	1.92	0.08	0.00	0.16	+1.15	0.9	1.43
4	−0.21	0.97	0.05	2.00	0.71	11.4	1.06	0.09	+0.01	0.18	1.84	1.0	1.43
6	+2.49	0.96	0.11	2.00	2.79	11.3	0.33	0.10	0.01	0.20	+0.43	1.1	1.43
12	+6.60	0.96	0.31	1.95	1.87	11.0	1.04	0.14	0.04	0.28	−0.04	1.6	1.43
22	−2.92	0.95	0.64	1.85	1.54	10.2	1.01	0.19	0.16	0.45	+1.05	2.5	1.43
30	−4.29	+0.95	−0.88	+1.75	−1.71	+ 9.5	0.31	−0.24	+0.23	−0.45	+1.28	−2.5	1.43

1883-84	P	E	F	G	$\Delta\alpha \cos\delta$	H	Wt.	J	K	L	$\Delta\delta$	M	Wt.
					″						″		
Aug. 2	−0.79	+0.94	−0.96	+1.68	−0.66	+9.2	1.56	−0.26	+0.27	−0.46	+0.90	−2.6	1.43
3	+0.50	0.94	0.99	1.66	3.10	9.2	0.44	0.26	0.28	0.47	−0.02	2.6	1.43
4	1.82	0.93	1.02	1.63	2.27	8.9	1.52	0.27	0.29	0.48	+0.51	2.6	1.43
5	3.01	0.93	1.04	1.61	1.21	8.8	1.33	0.27	0.30	0.48	0.02	2.6	1.43
6	4.09	0.93	1.07	1.59	1.83	8.7	1.52	0.28	0.32	0.48	0.14	2.6	1.43
7	4.98	0.93	1.09	1.58	3.17	8.6	0.98	0.28	0.33	0.48	0.79	2.6	1.43
11	6.35	0.93	1.20	1.48	2.09	8.1	0.97	0.30	0.39	0.48	0.88	2.6	1.43
16	2.73	0.93	1.31	1.39	3.01	7.3	0.42	0.32	0.46	0.48	0.07	2.5	1.43
18	+0.07	0.92	1.34	1.33	1.70	7.0	0.59	0.33	0.48	0.48	0.69	2.5	1.43
19	−1.23	0.92	1.36	1.30	2.26	6.8	0.59	0.33	0.49	0.47	0.40	2.4	1.43
21	3.54	0.92	1.41	1.24	1.82	6.5	1.67	0.34	0.53	0.46	+0.95	2.4	1.43
22	4.62	0.92	1.43	1.21	0.58	6.4	1.59	0.34	0.54	0.45	−0.11	2.4	1.43
24	5.73	0.92	1.47	1.18	1.14	6.1	1.59	0.35	0.56	0.45	+2.66	2.3	1.43
25	5.79	0.92	1.48	1.15	0.59	6.0	1.59	0.35	0.57	0.44	0.15	2.3	1.43
27	5.16	0.91	1.51	1.10	1.03	5.8	1.59	0.35	0.59	0.42	0.73	2.2	1.43
30	2.53	0.91	1 57	1.00	1.26	5.3	1.59	. .	. .	. .	. .	. .	. .
31	−1.40	0.91	1.58	0.98	0.23	5.2	1.72	0.36	0.63	0.39	0.23	2.1	1.43
Sept. 3	+2.26	0.90	1.64	+0.89	0.74	+4.7	0.69	0.37	0.67	−0.36	+1.02	−1.9	0.93
Oct. 9	+5.84	0.91	1.82	−0.22	2.58	−0.6	0.68	0.38	0.75	+0.09	−1.66	+0.2	0.93
16	−0.23	0.92	1.80	0.43	0.73	1.5	0.70	0.37	0.72	0.17	0.08	0.6	0.93
21	5.67	0.92	1.77	0.60	0.35	2.1	0.24	0.36	0.67	0.19	−1.21	0.8	0.93
23	6.12	0.93	1.76	0.66	0.22	2.4	0.67	0.35	0.65	0.25	+0.36	0.9	0.93
26	4.83	0.95	1.72	0.75	3.26	2.8	0.73	0.34	0.62	0.27	−0.53	1.0	0.93
27	−4.06	0.95	1.71	0.78	1.41	3.0	0.71	0.34	0.62	0.28	+3.07	1.1	0.93
Nov. 5	+5.56	0.97	1.59	1.05	2.23	4.1	0.74	0.31	0.50	0.33	2.97	1.3	0.93
10	+5.16	0.98	1.51	1.18	1.90	4.6	0.75	0.29	0.44	0.35	1.85	1.3	0.93
24	−5.72	0.99	1.21	1.53	1.54	5.8	0.80	0.21	0.25	0.32	0.03	1.2	0.93
27	−2.97	1.00	1.13	1.61	1.37	6.1	0.61	0.19	0.21	0.30	2.90	1.1	0.93
Dec. 4	+5.31	1.02	0.93	1.73	0.58	6.4	0.62	0.13	0.12	0.23	+1.61	0.9	0.94
5	5.95	1.02	0.90	1.76	0.03	6.5	0.71	0.13	0.12	0.23	−0.23	0.9	0.94
7	+6.46	1.02	0.83	1.79	1.74	6.6	0.73	0.11	0.09	0.20	+0.02	0.7	0.94
15	−1.96	1.03	0.58	1.91	2.37	6.9	0.72	0.05	0.03	0.10	1.07	0.3	0.94
17	4.52	1.03	0.52	1.93	−3.47	6.9	0.35	0.03	0.02	0.06	0.14	0.2	0.94
18	5.36	1.03	0.49	1.94	+0.11	6.9	0.75	−0.03	+0.01	+0.06	3.76	+0.2	0.94
1884 Jan. 24	−6.82	1.03	−0.29	1.98	−3.74	6.8	0.76	+0.02	−0.01	−0.04	3.77	−0.1	0.94
3	+5.59	1.03	+0.06	2.00	0.09	6.5	0.76	. .	. .	. .	. .	. .	. .
5	6.38	1.03	0.11	2.00	1.61	6.4	0.66	0.11	+0.01	0.22	0.06	0.7	0.94
9	3.84	1.02	0.26	1.96	0.92	6.0	0.76	0.14	0.04	0.28	+0.38	0.9	0.94
10	3.01	1.02	0.29	1.96	1.57	5.9	0.78	0.14	0.04	0.28	−0.11	0.9	0.94
11	+2.66	1.02	0.33	1.95	1.10	5.8	0.76	0.15	0.05	0.30	+0.06	0.9	0.94
18	−6.31	1.01	0.55	1.88	0.87	5.1	0.69	0.21	0.11	0.38	0.33	1.0	0.94
25	−3.52	1.00	0.77	1.78	1.09	4.6	0.65	0.25	0.19	0.44	0.36	1.1	0.94
31	+4.04	1.00	0.93	1.70	0.98	3.8	0.73	0.29	0.27	0.49	+0.82	1.1	0.94
Feb. 4	6.08	0.99	1.05	1.61	0.78	3.4	0.71	0.31	0.33	0.50	−0.43	1.1	0.94
5	5.79	0.99	1.08	1.59	1.10	3.3	0.71	0.31	0.34	0.50	−0.75	1.0	0.94
6	+5.25	0.99	1.10	1.57	−3.08	3.2	0.65	0.32	0.36	0.51	+0.13	1.0	0.94
12	−1.69	0.98	1.24	1.43	+0.64	2.5	0.68	0.34	0.43	0.50	+0.05	0.9	0.94
17	6.16	0.96	1.34	1.31	−2.21	1.8	0.53	0.36	0.50	0.49	−0.07	0.7	0.94
19	6.46	0.96	1.40	1.26	+0.86	1.6	0.66	0.36	0.52	0.47	+0.41	0.6	0.94
20	−5.91	0.96	1.42	1.23	−0.37	1.4	0.66	0.37	0.54	0.47	−0.43	0.5	0.94
27	+0.93	0.96	1.54	1.06	1.79	0.7	0.67	0.38	0.61	0.42	+1.55	0.3	0.94
28	2.36	0.95	1.56	1.03	1.14	0.5	0.68	0.39	0.63	0.41	−0.27	0.2	0.94
Mar. 2	5.17	0.95	1.60	0.94	3.39	0.2	0.94	0.39	0.65	0.38	−1.57	−0.1	1.23
3	5.66	0.95	1.62	0.91	1.31	−0.1	0.94	0.39	0.66	0.37	+0.66	0.0	1.23
4	+5.89	0.94	1.64	0.88	0.96	+0.1	0.94	0.39	0.69	0.37	−1.23	0.0	1.23
13	−2.00	0.94	1.76	0.61	0.49	1.4	0.97	0.40	0.76	0.26	−0.52	+0.6	1.23
14	3.14	0.94	1.76	0.59	2.66	1.6	0.89	0.40	0.76	0.25	+1.82	0.7	1.23
15	4.13	0.93	1.76	0.55	0.95	1.7	0.89	0.40	0.76	0.24	−1.75	0.7	1.23
16	4.98	0.93	1.77	0.52	1.24	1.8	0.81	0.40	0.77	0.22	−1.29	0.8	1.23
17	−5.61	+0.93	+1.78	−0.49	−0.06	+1.9	0.81	+0.40	+0.77	−0.21	+3.34	+0.8	1.23

1884	P	E	F	G	$\Delta\alpha \cos\delta$	H	Wt.	J	K	L	$\Delta\delta$	M	Wt.
					″						″		
Mar. 18	−6.06	+0.93	+1.78	−0.46	−1.60	+2.0	0.81	+0.40	+0.78	−0.20	+1.46	+0.9	1.23
19	6.25	0.93	1.79	0.42	+0.28	2.2	0.81	0.40	0.78	0.19	−0.40	1.0	1.23
22	5.35	0.93	1.80	0.34	+1.31	2.5	0.85	0.40	0.78	0.15	−1.19	1.0	1.23
23	4.49	0.93	1.81	0.30	−1.39	2.6	0.74	0.40	0.79	0.13	+0.36	1.1	1.23
24	−3.50	0.93	1.81	0.28	+0.60	2.8	0.89	0.40	0.79	0.12	−2.87	1.2	1.23
28	+1.66	0.93	1.83	0.15	−1.07	3.1	0.94	0.40	0.80	0.07	1.19	1.4	1.23
29	2.90	0.93	1.83	0.12	−0.01	3.2	0.94	0.39	0.78	0.05	1.31	1.4	1.23
30	3.98	0.93	1.84	0.08	+0.12	3.3	0.94	0.39	0.78	0.04	0.65	1.4	1.23
31	4.84	0.93	1.84	0.05	−0.24	3.4	0.82	0.39	0.78	0.02	2.23	1.4	1.23
April 1	5.46	0.93	1.84	−0.04	−0.03	3.5	0.89	0.39	0.78	−0.01	1.40	1.5	1.23
3	5.84	0.93	1.84	+0.05	+0.40	3.9	0.94	0.39	0.78	+0.02	1.70	1.6	1.23
9	+1.25	0.93	1.84	0.23	−1.86	4.2	0.98	0.38	0.75	0.10	−1.63	1.7	1.23
12	−2.34	0.93	1.83	0.33	+0.53	4.5	0.91	0.37	0.73	0.13	+1.05	1.8	1.23
May 22	3.22	0.94	1.25	1.47	−2.10	6.2	1.10	0.19	0.26	0.30	−0.41	1.3	1.23
23	2.07	0.94	1.23	1.50	1.67	6.2	1.10	0.19	0.25	0.31	+1.06	1.3	1.23
24	−0.67	0.94	1.21	1.53	2.23	6.2	1.05	0.18	0.24	0.30	−0.62	1.2	1.23
28	+4.59	0.95	1.11	1.62	0.07	6.1	1.05	. .	. .	. .	. .	. .	. .
30	+5.99	0.95	1.05	1.66	3.37	6.0	1.00	0.15	0.16	0.25	+0.49	1.0	1.23
June 13	−4.19	0.97	0.64	1.89	1.08	5.1	2.00	0.05	0.03	0.10	−0.47	0.3	1.43
14	5.82	0.97	0.61	1.90	0.50	5.0	1.75	0.05	+0.03	0.10	1.90	+0.3	1.43
19	4.79	0.97	0.44	1.95	0.50	4.5	1.45	+0.01	0.00	+0.02	−2.28	0.0	1.43
21	−2.46	0.97	0.38	1.96	3.68	4.3	0.59	0.00	0.00	0.00	+0.03	0.0	1.43
24	+1.81	0.97	0.28	1.98	0.78	4.0	1.45	−0.02	−0.01	−0.04	1.23	−0.1	1.43
25	. .	. .	. .	. .	. .	. .	. .	0.03	0.01	0.06	+0.31	0.1	1.43
27	5.29	0.97	0.17	1.99	0.92	3.7	1.85	0.05	0.01	0.10	−1.05	0.2	1.43
28	5.96	0.97	0.14	1.99	0.37	3.6	1.45	0.05	0.01	0.11	0.60	0.2	1.43
29	6.43	0.97	0.10	2.00	0.50	3.5	1.85	0.06	−0.01	0.12	0.13	0.2	1.43
30	6.58	0.97	0.07	2.00	0.64	3.3	1.85	0.07	0.00	0.14	0.54	0.2	1.43
July 1	6.40	0.97	+0.04	2.00	0.50	3.2	1.85	0.08	0.00	0.16	−1.38	0.3	1.43
2	6.03	0.97	0.00	2.00	1.47	3.1	1.85	0.08	0.00	0.17	+0.39	0.3	1.43
3	5.43	0.97	−0.04	2.00	−1.06	3.0	1.85	0.09	0.00	0.18	+0.17	0.3	1.43
4	4.62	0.97	0.07	2.00	+0.46	2.9	1.82	0.10	+0.01	0.19	−0.90	0.3	1.43
5	3.60	0.97	0.10	2.00	−0.37	2.8	1.21	0.10	0.01	0.20	0.71	0.3	1.43
7	+1.21	0.96	0.17	1.97	0.92	2.5	1.21	0.12	0.02	0.24	−0.31	0.3	1.43
8	−0.08	0.96	0.21	1.97	1.19	2.4	1.75	0.12	0.03	0.24	+1.15	0.3	1.43
9	1.38	0.96	0.24	1.96	−0.93	2.2	1.47	0.13	0.03	0.26	−0.32	0.3	1.43
11	3.78	0.96	0.30	1.95	+0.05	2.0	1.82	0.14	0.04	0.28	+0.03	0.3	1.43
12	4.60	0.96	0.37	1.94	−1.62	1.9	1.82	0.15	0.06	0.29	0.30	0.3	1.43
16	5.99	0.95	0.46	1.92	0.65	1.3	1.49	0.17	0.08	0.35	+0.51	0.2	1.43
18	−4.94	0.95	0.53	1.88	0.93	1.0	1.11	0.18	0.10	0.36	−1.39	0.2	1.43
23	+1.38	0.95	0.70	1.83	0.79	+0.3	1.82	0.21	0.16	0.41	−0.08	−0.1	1.43
31	5.80	0.94	0.93	1.71	−1.22	−0.6	1.70	0.25	0.25	0.46	+0.37	+0.2	1.43
Sept. 2	+3.53	0.91	1.63	0.90	+0.19	3.2	0.70	0.37	0.67	0.37	+0.04	1.3	0.93
10	−5.20	0.90	1.72	0.66	−1.14	3.4	0.59	0.39	0.73	0.28	−0.06	1.4	0.93
12	5.72	0.90	1.74	0.60	2.18	3.4	0.66	0.39	0.74	0.25	−1.08	1.4	0.93
13	5.58	0.90	1.75	0.57	2.28	3.4	0.59	0.39	0.74	0.24	+0.62	1.4	0.93
15	4.39	0.91	1.77	0.51	1.98	3.3	0.63	0.40	0.77	0.22	−0.43	1.4	0.93
17	2.38	0.91	1.78	0.44	0.52	3.3	0.68	0.40	0.78	0.19	+0.75	1.4	0.93
18	−1.18	0.91	1.79	0.41	1.52	3.3	0.68	0.40	0.78	0.18	+0.18	1.4	0.93
20	+1.33	0.91	1.80	0.34	2.40	3.2	0.68	0.40	0.78	0.15	−0.69	1.4	0.93
21	2.44	0.91	1.81	0.32	2.31	3.2	0.70	0.40	0.79	0.14	0.76	1.4	0.93
22	3.62	0.91	1.81	0.29	0.60	3.2	0.61	0.40	0.79	0.13	0.22	1.4	0.93
24	5.29	0.91	1.82	0.23	1.76	3.1	0.73	0.40	0.79	0.10	1.75	1.4	0.93
25	5.86	0.91	1.83	0.20	2.40	3.1	0.68	0.40	0.80	0.09	−1.02	1.4	0.93
26	6.17	0.91	1.83	0.17	2.31	3.0	0.68	0.40	0.80	0.07	+0.31	1.3	0.93
27	6.26	0.91	1.83	0.14	2.83	3.0	0.70	0.40	0.80	0.06	−0.05	1.3	0.93
29	5.68	0.91	1.84	0.07	2.04	2.9	0.59	0.40	0.80	0.04	+0.49	1.2	0.93
30	5.09	0.91	1.84	+0.05	2.50	2.9	0.70	0.40	0.80	−0.02	−0.72	1.2	0.93
Oct. 21	2.97	0.95	1.77	−0.61	3.21	1.5	0.74	0.36	0.68	+0.23	+0.27	0.6	0.93
22	+4.02	+0.95	−1.76	−0.64	−2.95	−1.4	0.74	−0.35	+0.66	+0.24	+1.76	+0.5	0.93

1884 85	P	E	F	G	$\Delta\alpha \cos\delta$	H	Wt.	J	K	L	$\Delta\delta$	M	Wt.
					″						″		
Oct. 23	+4.91	+0.95	−1.75	−0.68	−3.28	−1.3	0.74	−0.35	+0.65	+0.26	−0.35	+0.5	0.93
24	5.59	0.95	1.74	0.71	3.36	1.2	0.70	0.35	0.65	0.26	0.20	0.5	0.93
25	+6.07	0.95	1.73	0.74	0.83	1.1	0.74	0.34	0.63	0.27	0.53	0.4	0.93
Nov. 3	−0.19	0.97	1.62	1.02	2.99	−0.3	0.66	0.32	0.53	0.33	−0.16	+0.1	0.93
6	4.07	0.97	1.56	1.10	0.29	+0.1	0.74	0.31	0.49	0.35	+0.76	0.0	0.93
15	2.81	0.98	1.37	1.33	1.91	1.2	0.76	0.26	0.36	0.35	0.90	−0.3	0.93
17	0.33	0.99	1.34	1.39	3.50	1.4	0.68	0.25	0.33	0.34	0.20	0.4	0.93
Dec. 8	6.33	1.02	0.78	1.82	0.02	3.8	0.73	0.10	0.08	0.18	1.28	0.4	0.94
10	6.53	1.03	0.72	1.85	0.99	4.0	0.81	0.08	0.06	0.15	0.19	0.3	0.94
13	4.81	1.03	0.63	1.89	2.11	4.3	0.71	0.06	0.04	0.12	+0.78	0.3	0.94
14	3.74	1.03	0.60	1.91	4.71	4.4	0.75	0.05	0.03	0.10	−1.76	0.2	0.94
16	−1.41	1.03	0.53	1.93	2.95	4.7	0.71	0.04	0.02	0.08	+0.91	0.2	0.94
18	+1.45	1.03	0.46	1.95	2.68	4.9	0.75	−0.02	+0.01	+0.04	1.94	−0.1	0.94
1885 28	+5.72	1.03	−0.12	1.99	0.26	5.8	0.75	+0.05	−0.01	−0.10	+1.34	+0.3	0.94
Jan. 3	−3.24	1.03	+0.08	2.00	1.81	6.2	0.71	0.10	+0.01	0.20	−1.84	0.6	0.94
4	4.47	1.03	0.11	2.00	1.70	6.3	0.71	0.11	0.01	0.22	+0.55	0.7	0.94
9	6.66	1.02	0.29	1.96	1.79	6.6	0.74	0.14	0.04	0.28	+1.06	0.9	0.94
15	−1.53	1.02	0.47	1.92	2.71	6.9	0.58	0.20	0.09	0.37	−1.26	1.3	0.94
18	+2.67	1.00	0.57	1.87	3.91	7.0	0.72	0.21	0.12	0.38	0.24	1.4	0.94
20	4.76	1.00	0.64	1.85	1.92	7.1	0.68	0.23	0.14	0.42	0.30	1.6	0.94
21	5.54	1.00	0.67	1.84	1.39	7.1	0.72	0.23	0.15	0.42	0.53	1.6	0.94
22	6.07	1.00	0.71	1.82	2.04	7.2	0.72	0.24	0.17	0.43	−0.80	1.7	0.94
27	4.29	0.99	0.85	1.75	2.48	7.2	0.66	0.27	0.23	0.47	+0.72	1.9	0.94
28	3.02	0.99	0.89	1.73	1.45	7.3	0.70	0.27	0.24	0.47	−1.63	2.0	0.94
29	+1.71	0.99	0.93	1.70	0.12	7.3	0.66	0.28	0.26	0.47	0.04	2.0	0.94
Feb. 2	−3.73	0.99	1.02	1.63	1.42	7.2	0.65	0.30	0.31	0.49	−0.17	2.2	0.94
6	6.44	0.99	1.12	1.56	2.17	7.2	0.54	0.32	0.36	0.50	+0.46	2.3	0.94
8	−6.29	0.98	1.16	1.53	1.33	7.0	0.69	0.33	0.39	0.51	+0.90	2.4	0.94
24	+5.21	0.96	1.51	1.13	−0.04	6.5	0.68	0.38	0.60	0.44	−0.74	2.6	0.94
25	4.43	0.96	1.53	1.09	+2.10	6.4	0.65	0.38	0.60	0.43	0.44	2.5	0.94
26	3.40	0.96	1.55	1.06	−0.50	6.3	0.69	0.38	0.61	0.42	0.39	2.5	0.94
27	+2.22	0.96	1.56	1.03	+2.29	6.3	0.67	0.39	0.63	0.42	1.71	2.5	0.94
Mar. 2	−1.73	0.95	1.60	0.95	1.06	6.0	0.93	0.39	0.65	0.39	1.14	2.5	1.23
10	5.99	0.94	1.71	0.72	+1.13	5.7	0.93	0.39	0.72	0.30	−0.53	2.4	1.23
12	4.77	0.94	1.74	0.66	−2.29	5.5	0.89	0.40	0.75	0.28	+0.28	2.4	1.23
13	3.87	0.94	1.75	0.62	0.65	5.4	0 95	0.40	0.77	0.27	+0.83	2.3	1.23
14	2.79	0.94	1.76	0.59	−0.16	5.3	0.95	0.40	0.77	0.26	−1.86	2.3	1.23
16	−0.33	0.93	1.76	0.52	+1.50	5.1	0.81	0.40	0.77	0.23	+0.15	2.2	1.23
17	+0.96	0.93	1.77	0.50	−0.83	5.0	0.94	0.40	0.77	0.22	−1.81	2.2	1.23
20	4.27	0.93	1.79	0.40	−0.63	4.8	0.89	0.40	0.78	0.18	0.73	2.1	1.23
23	+5.76	0.93	1.81	0.32	+0.82	4.5	0.89	0.40	0.79	0.14	1.02	2.0	1.08
31	−0.99	0.93	1.84	0.06	−1.39	3.6	0.96	0.39	0.78	0.03	1.80	1.5	1.23
April 1	2.23	0.93	1.84	−0.04	1.02	3.4	0.96	0.39	0.78	−0.02	0.93	1.4	1.23
2	3.36	0.93	1.84	0.00	0.84	3.3	0.89	0.39	0.78	0.00	0.60	1.4	1.23
3	4.35	0.93	1.84	+0.04	1.45	3.1	1.00	0.39	0.78	+0.02	−0.94	1.3	1.23
4	−5.14	0.93	1.84	0.06	0.37	3.0	0.98	0.39	0.78	0.03	+0.47	1.3	1.23
15	+0.32	0.93	1.81	0.42	0.43	1.5	1.00	0.37	0.72	0.07	+0.05	0.6	1.23
18	4.00	0.93	1.79	0.50	2.30	1.0	0.97	0.36	0.69	0.20	−3.49	0.4	1.23
19	4.77	0.93	1.78	0.53	0.02	0.9	1.01	0.35	0.67	0.20	1.73	0.4	1.23
21	5.81	0.93	1.78	0.60	−1.11	0.6	0.97	0.35	0.66	0.22	1.33	0.2	1.23
22	+5.85	0.93	1.77	0.63	+0.21	+0.5	0.82	0.34	0.64	0.23	0.86	+0.2	1.89
June 2	−5.14	0.96	0.99	1.71	+0.65	−5.0	1.89	0.13	0.13	0.23	0.28	−0.7	1.43
3	5.81	0.96	0.96	1.73	−0.72	5.2	1.85	0.13	0.13	0.23	1.12	0.7	1.43
4	6.30	0.96	0.93	1.75	0.27	5.3	1.79	0.12	0.11	0.21	1.29	0.6	1.43
5	6.50	0.96	0.90	1.76	−0.89	5.4	1.85	0.11	0.10	0.20	−0.80	0.6	1.43
6	6.42	0.96	0.87	1.78	+0.46	5.6	1.92	0.11	0.09	0.18	+0.81	0.6	1.43
7	6.12	0.96	0.83	1.79	+0.95	5.7	1.82	0.10	0.08	0.18	−0.49	0.6	1.43
8	5.46	0.96	0.80	1.81	−0.62	5.8	1.82	0.09	0.07	0.16	0.43	0.5	1.43
9	4.55	0.96	0.78	1.82	−0.43	6.0	1.67	0.09	0.07	0.16	0.45	0.5	1.43
11	−2.06	+0.97	+0.72	+1.87	+0.72	−6.4	1.82	+0.07	+0.05	+0.13	−0.51	−0.4	1.43

1885–86	P	E	F	G	$\Delta\alpha \cos\delta$	H	Wt.	J	K	L	$\Delta\delta$	M	Wt.
					″						″		
June 12	−0.69	+0.97	+0.68	+1.88	−0.84	−6.5	1.85	+0.06	+0.04	+0.11	−0.27	−0.4	1.43
13	+0.79	0.97	0.65	1.89	1.49	6.7	1.82	0.05	0.03	0.10	−1.08	0.3	1.43
14	2.22	0.97	0.62	1.90	0.90	6.8	1.82	0.05	0.03	0.10	+0.31	0.3	1.43
15	3.64	0.97	0.58	1.91	−0.72	7.0	1.67	0.04	0.02	0.08	−0.37	0.3	1.43
16	4.62	0.97	0.55	1.92	+0.63	7.0	1.25	0.03	0.02	0.06	0.31	0.2	1.43
17	5.49	0.97	0.52	1.93	−1.58	7.1	0.59	0.03	+0.02	0.06	0.62	0.2	1.43
19	6.34	0.97	0.45	1.95	1.75	7.4	1.67	+0.01	0.00	+0.02	−0.13	−0.1	1.43
23	4.65	0.97	0.31	1.97	1.89	7.7	1.45	−0.02	−0.01	−0.04	+0.55	+0.2	1.43
24	3.63	0.97	0.28	1.98	2.59	7.8	1.82	0.02	0.01	0.05	+1.75	0.2	1.43
25	2.52	0.97	0.25	1.98	2.48	7.9	1.82	0.03	0.01	0.06	−0.71	0.2	1.43
26	1.29	0.97	0.21	1.99	1.17	8.0	1.54	0.04	0.01	0.08	0.77	0.3	1.43
27	+0.01	0.97	+0.18	1.99	0.95	8.1	1.67	0.05	−0.01	0.10	−2.76	0.4	1.43
July 8	−4.82	0.96	−0.19	1.97	0.12	8.8	1.67	. .	. .	. .	. .	. .	. .
9	3.76	0.96	0.23	1.97	1.58	8.8	1.61	0.13	+0.03	0.26	+0.38	1.2	1.43
10	2.47	0.96	0.26	1.96	0.02	8.8	1.61	0.14	0.04	0.27	−0.52	1.2	1.43
11	−1.10	0.96	0.30	1.94	2.22	8.9	1.61	0.14	0.04	0.28	−0.22	1.3	1.43
23	+4.17	0.95	0.69	1.84	0.67	9.4	1.72	0.21	0.15	0.41	+0.20	2.1	1.43
24	+3.14	0.95	0.72	1.82	−1.45	9.4	1.72	0.21	0.16	0.41	0.09	2.1	1.43
28	−1.70	0.94	0.82	1.75	+0.70	9.5	1.70	0.24	0.21	0.45	+0.04	2.5	1.43
31	4.81	0.94	0.93	1.72	−1.07	9.5	1.54	0.25	0.24	0.46	−0.32	2.5	1.43
Aug. 1	5.39	0.94	0.95	1.69	−0.70	9.5	1.45	0.26	0.26	0.47	+0.46	2.6	1.43
2	5.88	0.94	0.98	1.67	+0.14	9.5	0.95	0.26	0.27	0.47	0.49	2.6	1.89
3	−6.08	0.94	1.00	1.67	−0.33	9.5	1.41	0.27	0.29	0.48	0.57	2.7	1.43
10	+0.11	0.94	1.18	1.52	−0.75	9.4	1.41	. .	. .	. .	. .	. .	. .
12	2.62	0.93	1.22	1.49	+0.19	9.3	1.37	0.31	0.41	0.49	+0.71	3.1	1.89
13	3.79	0.93	1.24	1.43	0.13	9.3	1.15	0.31	0.42	0.48	−0.07	3.1	1.89
15	5.53	0.93	1.29	1.39	+0.56	9.3	1.37	0.32	0.45	0.48	−0.12	3.2	1.89
17	6.21	0.93	1.34	1.34	−0.51	9.2	1.16	0.32	0.47	0.47	+0.53	3.2	1.89
25	+0.47	0.92	1.49	1.13	+0.42	8.9	1.41	0.35	0.58	0.43	0.70	3.4	1.89
26	−0.93	0.92	1.51	1.11	+0.05	8.9	1.24	0.35	0.58	0.42	+1.51	3.4	1.89
Sept. 3	−5.44	0.91	1.64	0.88	−0.86	8.5	0.72	0.37	0.67	0.36	−0.16	3.5	0.93
10	+2.11	0.90	1.71	0.67	−0.71	8.1	0.83	0.39	0.73	0.29	−0.18	3.4	1.89
13	5.12	0.90	1.75	0.58	+0.52	8.1	1.47	0.39	0.74	0.25	+1.03	3.4	1.89
14	5.74	0.90	1.76	0.55	−0.69	8.0	1.35	0.40	0.76	0.24	1.58	3.4	1.89
15	6.11	0.91	1.77	0.52	0.42	7.9	1.39	0.40	0.77	0.22	1.22	3.4	1.89
16	6.21	0.91	1.78	0.49	0.20	7.8	1.32	0.40	0.77	0.21	0.03	3.4	1.89
17	6.09	0.91	1.79	0.46	1.46	7.7	1.28	0.40	0.78	0.20	1.03	3.4	1.89
18	5.73	0.91	1.79	0.42	1.23	7.7	1.25	0.40	0.78	0.19	0.10	3.4	1.89
22	2.24	0.91	1.81	0.32	0.87	7.6	1.32	0.40	0.79	0.13	0.15	3.3	1.89
23	1.07	0.91	1.82	+0.27	−0.49	7.5	1.39	0.40	0.79	−0.12	1.60	3.3	1.89
Oct. 14	5.88	0.92	1.80	−0.39	+2.14	5.5	1.09	0.38	0.74	+0.16	+1.71	2.2	1.89
16	6.35	0.92	1.80	0.46	−1.24	5.3	1.37	0.37	0.72	0.18	−1.87	2.1	1.89
17	6.12	0.93	1.79	0.48	2.05	5.2	1.24	0.37	0.71	0.20	+0.09	2.1	1.89
19	+5.19	0.93	1.78	0.54	1.63	5.0	1.32	0.36	0.69	0.21	−1.08	1.9	1.89
Nov. 2	−4.95	0.97	1.62	0.98	1.55	3.9	1.09	. .	. .	. .	. .	. .	. .
3	4.06	0.97	1.62	1.01	0.18	3.8	1.09	0.32	0.53	0.33	−0.67	1.2	1.89
Dec. 2	4.83	1.01	0.96	1.70	2.35	1.5	0.78	0.14	0.14	0.25	+1.70	0.2	0.94
3	3.85	1.01	0.95	1.72	1.03	1.4	0.74	0.14	0.13	0.24	−0.08	0.2	0.94
4	−2.69	1.02	0.93	1.75	2.94	1.3	0.67	0.13	0.12	0.23	−0.51	0.2	0.94
9	+3.69	1.02	0.76	1.82	3.35	1.1	0.71	0.09	0.07	0.16	+0.27	+0.1	0.94
19	3.46	1.03	0.44	1.96	2.19	0.7	0.79	−0.02	+0.01	+0.04	0.37	0.0	0.94
27	6.61	1.03	0.16	1.99	2.31	0.6	0.73	+0.05	−0.01	−0.20	1.71	0.0	0.94
28	6.72	1.03	−0.14	1.99	5.26	0.6	0.71	0.05	−0.01	0.20	0.83	0.0	0.94
1886 Jan. 6	1.48	1.02	+0.17	1.97	3.04	0.6	0.63	0.12	+0.02	0.24	+0.01	−0.1	0.94
11	6.24	1.02	0.35	1.95	2.39	0.8	0.76	0.16	0.06	0.32	−4.70	0.1	0.94
13	6.55	1.02	0.41	1.94	1.67	0.8	0.61	0.18	0.07	0.33	+1.05	0.1	0.94
Feb. 4	0.40	0.99	1.07	1.60	3.64	2.1	0.65	0.31	0.33	0.50	0.33	0.7	0.94
8	4.78	0.98	1.16	1.53	0.10	2.4	1.28	0.33	0.39	0.51	0.07	0.8	1.89
9	5.46	0.98	1.19	1.49	2.63	2.5	1.15	0.33	0.40	0.50	+1.67	0.8	1.89
14	+5.11	+0.98	+1.31	−1.38	−3.20	−2.9	0.63	+0.35	+0.47	−0.49	−1.54	−1.0	0.94

1886	P	E	F	G	$\Delta\alpha \cos\delta$	H	Wt.	J	K	L	$\Delta\delta$	M	Wt.
					″						″		
Feb. 22	−4.62	+0.96	+1.47	−1.18	−0.98	−3.6	0.65	+0.37	+0.56	−0.45	−1.30	−1.4	0.94
24	5.93	0.96	1.50	1.14	1.07	3.8	0.65	0.38	0.60	0.44	−0.42	1.5	0.94
25	6.20	0.96	1.52	1.10	1.40	3.9	0.64	0.38	0.60	0.43	+0.88	1.5	0.94
Mar. 1	4.80	0.95	1.58	0.98	−0.71	4.0	1.08	. .	. .	. .	. .	. .	. .
4	−2.70	0.95	1.63	0.89	+1.81	4.2	1.08	0.39	0.69	0.37	0.23	1.8	1.89
7	+1.90	0.94	1.67	0.81	−1.68	4.4	1.30	0.39	0.70	0.34	+0.16	1.8	1.89
8	3.01	0.94	1.68	0.78	0.54	4.4	1.37	0.39	0.71	0.33	−1.49	1.8	1.89
11	5.45	0.94	1.72	0.70	1.11	4.7	1.41	0.39	0.72	0.29	1.32	2.0	1.89
13	5.87	0.93	1.75	0.63	0.52	4.7	1.28	0.40	0.75	0.27	−0.37	2.0	1.89
17	3.44	0.93	1.77	0.51	−1.08	4.9	1.39	0.40	0.77	0.22	+0.18	2.1	1.89
18	2.28	0.93	1.78	0.48	+1.50	4.9	1.45	0.40	0.77	0.21	+1.37	2.1	1.89
19	+0.95	0.93	1.78	0.44	−2.36	4.9	1.47	0.40	0.78	0.19	−0.35	2.1	1.89
20	−0.40	0.93	1.79	0.41	0.34	4.9	1.06	0.40	0.78	0.18	+0.05	2.1	1.89
24	4.96	0.93	1.81	0.29	−0.48	5.0	1.06	0.40	0.79	0.12	−0.51	2.2	1.89
25	5.20	0.93	1.82	0.26	+0.53	5.0	0.81	0.40	0.79	0.11	−2.09	2.2	1.89
27	6.23	0.93	1.83	0.19	−1.28	5.0	1.39	0.40	0.80	0.08	+0.22	2.2	1.89
28	6.15	0.93	1.83	0.16	+0.47	5.0	0.87	0.40	0.80	0.07	0.75	2.2	1.89
30	5.27	0.93	1.84	0.10	+1.29	5.0	1.39	0.39	0.79	0.04	3.40	2.1	1.89
31	4.65	0.93	1.84	0.07	−0.19	5.0	1.19	0.39	0.78	0.03	+0.10	2.1	1.89
April 1	3.69	0.93	1.84	0.04	−1.33	5.0	1.49	0.39	0.78	−0.02	−0.55	2.1	1.89
2	2.69	0.93	1.84	−0.01	+1.52	5.0	1.61	0.39	0.78	0.00	+0.68	2.1	1.08
3	−1.55	0.93	1.84	+0.03	−0.24	5.0	1.30	0.39	0.78	+0.01	−0.07	2.1	1.89
5	+1.13	0.93	1.84	0.08	−0.38	5.0	1.41	0.39	0.78	0.04	0.94	2.1	1.89
7	3.41	0.93	1.84	0.15	+0.37	4.9	1.45	0.38	0.76	0.06	0.20	2.0	1.89
8	4.36	0.93	1.84	0.18	−1.29	4.8	1.43	0.38	0.76	0.08	−1.08	2.0	1.89
11	5.81	0.93	1.84	0.28	0.85	4.7	1.52	0.38	0.74	0.11	+1.25	1.9	1.89
12	5.73	0.93	1.84	0.31	0.16	4.7	1.49	0.37	0.73	0.12	−1.70	1.9	1.89
14	4.72	0.93	1.82	0.37	0.32	4.6	1.37	0.37	0.73	0.15	1.24	1.8	1.89
15	+3.81	0.93	1.81	0.40	0.15	4.5	1.24	0.37	0.72	0.16	1.35	1.8	1.89
20	−2.45	0.93	1.77	0.56	−0.20	4.2	1.41	0.35	0.67	0.21	−0.57	1.6	1.89
23	5.39	0.93	1.77	0.66	+0.24	3.9	1.54	0.35	0.64	0.24	+0.32	1.4	1.89
24	5.97	0.93	1.75	0.69	−0.11	3.9	1.47	0.34	0.63	0.25	−0.44	1.4	1.89
25	6.36	0.93	1.74	0.71	−1.65	3.9	1.27	0.34	0.63	0.26	−1.32	1.4	1.89
26	6.43	0.93	1.73	0.74	+0.86	3.9	1.27	0.33	0.61	0.26	+1.63	1.4	1.89
27	6.28	0.93	1.72	0.77	−0.73	3.8	1.85	0.33	0.60	0.27	+0.07	1.3	1.08
28	5.94	0.93	1.72	0.80	−2.86	3.7	1.27	0.32	0.58	0.27	−0.22	1.2	1.08
May 2	2.15	0.93	1.65	0.93	+1.11	3.6	1.82	0.31	0.54	0.31	−0.71	1.2	1.08
3	−0.85	0.93	1.64	0.96	0.73	3.4	1.96	0.29	0.52	0.31	+0.91	1.1	1.89
4	+0.46	0.94	1.64	0.98	+0.37	3.4	1.47	0.29	0.51	0.31	0.23	1.1	1.89
6	2.97	0.94	1.60	1.06	−0.46	3.3	1.52	0.28	0.48	0.32	1.01	1.0	1.89
7	4.03	0.94	1.58	1.08	0.69	3.1	1.49	0.28	0.48	0.33	+1.22	0.9	1.89
8	4.93	0.94	1.57	1.11	--1.80	3.0	1.52	0.27	0.46	0.33	−0.04	0.9	1.89
9	5.54	0.94	1.55	1.13	+3.5	2.9	1.92	0.27	0.45	0.33	+0.13	0.8	1.08
10	+5.85	0.94	1.53	1.16	−1.71	2.8	1.39	0.27	0.43	0.33	0.51	0.8	1.08
18	−0.57	0.94	1.37	1.37	0.54	1.6	2.27	0.22	0.32	0.32	+0.08	0.4	1.08
19	1.84	0.94	1.35	1.39	−0.59	1.5	2.13	0.21	0.31	0.32	−0.70	0.4	1.08
20	3.07	0.94	1.32	1.42	+0.18	1.4	2.08	0.21	0.30	0.32	+0.04	0.3	1.08
21	. .	. .	. .	. .	. .	. .	. .	0.20	0.28	0.31	0.17	0.3	1.08
22	5.38	0.94	1.27	1.46	−0.39	1.2	1.92	0.19	0.26	0.31	1.06	0.2	1.08
23	5.84	0.94	1.24	1.48	0.28	1.0	1.96	0.19	0.26	0.31	0.54	−0.1	1.08
28	5.73	0.95	1.13	1.61	−0.92	0.5	2.08	0.16	0.20	0.28	0.07	0.0	1.08
31	2.80	0.95	1.04	1.67	+0.07	−0.2	2.13	0.15	0.16	0.26	0.27	0.0	1.08
June 1	1.53	0.95	1.02	1.68	−0.65	+0.1	2.04	0.14	0.14	0.24	+0.41	0.0	1.64
2	−0.13	0.96	0.99	1.70	1.58	0.3	1.96	0.13	0.13	0.22	−0.03	+0.1	1.64
12	. .	. .	. .	. .	. .	. .	. .	0.06	0.04	0.11	0.95	0.1	1.89
16	+0.16	0.97	0.56	1.92	0.01	2.7	0.81	0.04	0.02	0.08	0.47	+0.1	1.64
17	−1.19	0.97	0.53	1.93	0.22	2.8	1.35	+0.03	+0.02	+0.06	1.11	−0.1	1.64
25	6.52	0.97	0.26	1.98	1.47	4.0	2.38	−0.03	−0.01	−0.06	−0.28	0.2	1.64
26	6.11	0.97	0.22	1.99	1.55	4.1	2.08	0.04	0.01	0.08	+1.06	0.2	1.64
27	−5.37	+0.97	+0.19	+1.99	−0.32	+4.3	1.32	−0.04	−0.01	−0.08	+0.02	−0.2	1.89

1886	P	E	F	G	$\Delta\alpha \cos\delta$	H	Wt.	J	K	L	$\Delta\delta$	M	Wt.
					″						″		
June 29	−3.38	+0.97	+0.12	+1.99	−1.02	+4.6	1.82	−0.06	−0.01	−0.12	−1.83	−0.3	1.64
30	2.05	0.97	0.08	2.00	0.74	4.8	1.82	. .	. .	. .	. .	. .	. .
July 1	−0.64	0.97	0.05	2.00	0.67	4.9	2.44	0.07	0.00	0.14	−0.26	0.3	1.64
2	+0.79	0.97	+0.02	2.00	0.34	5.1	2.44	0.08	0.00	0.16	+0.81	0.4	1.64
3	2.20	0.97	−0.02	2.00	1.22	5.2	2.44	0.09	0.00	0.18	−0.12	0.5	1.64
4	3.47	0.97	0.05	2.00	0.71	5.4	1.92	0.09	0.00	0.18	−0.27	0.5	1.64
5	4.53	0.97	0.08	2.00	1.38	5.5	2.17	0.10	+0.01	0.20	+0.25	0.6	1.64
6	5.36	0.96	0.12	2.00	−0.51	5.6	2.13	0.10	0.01	0.20	−1.14	0.6	1.64
7	5.91	0.96	0.15	1.97	+0.81	5.7	1.24	0.11	0.02	0.22	−0.35	0.6	1.64
10	5.74	0.96	0.25	1.96	−0.22	6.1	1.32	0.13	0.03	0.26	+0.40	0.8	1.64
11	5.15	0.96	0.29	1.96	+0.03	6.3	1.79	0.14	0.04	0.28	1.50	0.9	1.64
12	+4.33	0.96	0.32	1.95	−0.98	6.4	1.79	0.15	0.05	0.30	1.12	1.0	1.64
17	−1.63	0.95	0.48	1.90	1.12	7.1	1.54	0.17	0.09	0.35	+0.12	1.3	1.64
18	2.81	0.95	0.52	1.89	−0.41	7.2	2.00	0.18	0.10	0.37	−0.04	1.3	1.64
19	3.91	0.95	0.55	1.88	+0.21	7.3	2.27	0.18	0.11	0.37	+2.47	1.3	1.64
20	4.77	0.95	0 58	1.87	−0.97	7.4	1.30	0.19	0.12	0.38	0.81	1.4	1.64
22	6.10	0.95	0.64	1.85	0.49	7.6	1.82	0.20	0.14	0.40	+0.81	1.6	1.64
25	6.06	0.95	0.73	1.81	−2.20	7.9	0.58	0.22	0.17	0.43	−0.50	1.9	1.64
29	2.44	0.94	0.85	1.76	+0.06	8.3	2.22	0.24	0.22	0.45	+0.35	2.2	1.64
30	−1.10	0.94	0.88	1.73	−1.17	8.4	2.08	0.24	0.23	0.45	0.75	2.2	1.64
Aug. 1	+1.76	0.94	0.94	1.70	0.29	8.6	1.79	0.25	0.25	0.46	+0.97	2.3	1.64
3	4.38	0.94	1.00	1.66	−0.69	8.8	1.79	0.26	0.28	0.46	−1.74	2.5	1.64
4	5.03	0.93	1.02	1.63	+1.68	8.9	0.57	0.27	0.30	0.48	+0.75	2.6	1.64
5	5.66	0.93	1.05	1.61	−0.97	8.9	1.79	0.27	0.31	0.48	+0.85	2.6	1.64
6	6.04	0.93	1.08	1.59	0.63	9.0	1.79	0.28	0.32	0.48	−1.73	2.7	1.64
8	5.87	0.93	1.13	1.56	0.48	9.1	2.17	0.29	0.35	0.49	+0.49	2.9	1.64
9	5.39	0.93	1.15	1.54	0.88	9.2	1.47	0.29	0.36	0.49	1.79	2.9	1.89
10	4.68	0.93	1.18	1.52	−1.54	9.3	1.52	0.30	0.38	0.49	+0.18	3.0	1.89
12	2.83	0.93	1.22	1.47	+0.06	9.3	1.49	0.31	0.41	0.50	−1.53	3.1	1.89
13	+1.56	0.93	1.24	1.43	−1.01	9.4	1.49	0.31	0.42	0.48	+0.98	3.2	1.89
15	−0.86	0.93	1.29	1.39	1.98	9.5	1.41	0.32	0.45	0.48	−2.09	3.3	1.89
16	2.07	0.93	1.32	1.37	0.74	9.6	1.54	0.32	0.46	0.47	+0.45	3.3	1.89
21	5.90	0.92	1.42	1.23	0.25	9.8	1.45	0.34	0.53	0.46	−0.52	3.6	1.89
22	6.07	0.92	1.43	1.21	1.75	9.8	1.41	0.34	0.53	0.45	+0.85	3.6	1.89
23	5.99	0.92	1.45	1.19	1.52	9.9	1.11	0.34	0.54	0.44	0.88	3.7	1.89
27	2.73	0.91	1.52	1.08	0.95	9.9	1.39	0.35	0.59	0.42	+1.07	3.8	1.89
28	1.45	0.91	1.53	1.05	1.57	9.9	1.54	0.36	0.61	0.42	−0.49	3.9	1.89
29	−0.08	0.91	1.55	1.02	2.12	9.9	1.43	0.36	0.62	0.41	0.38	3.9	1.89
30	+1.28	0.91	1.57	1.00	1.06	10.0	1.39	0.36	0.63	0.40	0.08	4.0	1.89
31	2.56	0.91	1.59	0.97	0.55	10.0	1.43	0.36	0.63	0.38	−0.87	4.0	1.89
Sept. 1	3.74	0.91	1.60	0.94	1.81	10.0	1.52	0.37	0.65	0.38	+1.17	4.1	1.89
2	4.71	0.91	1.62	0.89	0.55	10.0	1.35	0.37	0.66	0.37	1.85	4.1	1.89
6	5.92	0.90	1.66	0.79	1.54	9.8	1.24	0.38	0.71	0.33	0.03	4.2	1.89
7	5.62	0.90	1.68	0.75	3.56	9.8	0.27	0.38	0.71	0.32	1.61	4.2	1.89
9	4.27	0.90	1.69	0.71	1.16	9.8	1.30	0.39	0.72	0.30	1.02	4.2	1.89
11	2.29	0.90	1.72	0.64	2.94	9.8	0.27	0.39	0.73	0.28	+0.21	4.2	1.89
12	+1.13	0.90	1.73	0.62	3.62	9.8	0.21	0.39	0.73	0.26	−0.25	4.2	1.89
13	−0.05	0.90	1.74	0.59	−0.33	9.8	0.68	0.39	0.74	0.25	+1.13	4.2	0.94
14	1.23	0.90	1.75	0.56	+0.24	9.8	0.49	0.40	0.76	0.24	−0.40	4.3	0.94
15	2.38	0.91	1.76	0.52	+0.84	9.8	0.49	0.40	0.76	0.23	−0.13	4.3	0.94
17	4.32	0.91	1.78	0.46	−0.50	9.8	0.49	0.40	0.77	0.20	+0.83	4.2	0.94
18	4.97	0.91	1.78	0.43	1.12	9.8	0.49	0.40	0.78	0.19	−2.10	4.2	0.94
19	5.58	0.91	1.79	0.40	2.52	9.8	0.40	0.40	0.78	0.18	2.04	4.2	0.94
24	4.22	0.91	1.82	0.25	2.43	9.7	0.83	0.40	0.79	0.11	−2.33	4.2	0.94
25	3.14	0.91	1.82	0.21	1.21	9.6	0.83	0.40	0.79	0.09	+0.14	4.2	0.94
27	−0.50	0.91	1.83	0.16	1.42	9.5	1.01	0.40	0.80	0.07	0.92	4.1	1.89
29	+2.13	0.91	1.84	0.09	0.28	9.4	1.28	0.40	0.80	0.04	1.15	4.1	1.89
30	3.33	0.91	1.84	0.06	0.33	9.3	0.89	0.40	0.80	0.03	1.09	4.0	0.94
Oct. 1	4.37	0.91	1.84	+0.04	0.93	9.3	0.87	0.40	0.80	−0.02	1.38	4.0	0.94
2	+5.19	+0.91	−1.84	0.00	−0.67	+9.2	0.50	−0.39	+0.79	0.00	+0.62	−3.9	0.94

1886-87	P	E	F	G	$\Delta\alpha \cos\delta$	H	Wt.	J	K	L	$\Delta\delta$	M	Wt.
					″						″		
Oct. 3	+5.78	+0.91	−1.84	−0.04	−1.78	+9.1	0.40	−0.39	+0.78	+0.02	+0.70	−3.9	0.94
4	6.11	0.91	1.84	0.06	1.40	9.0	1.21	0.39	0.78	0.03	−1.49	3.8	1.89
8	+4.89	0.91	1.83	0.19	0.20	8.7	0.47	0.39	0.78	0.08	+0.91	3.7	0.94
20	−5.95	0.95	1.77	0.58	0.65	7.6	0.86	0.36	0.68	0.22	0.44	3.0	1.89
25	2.43	0.95	1.73	0.72	2.09	7.2	0.86	0.35	0.64	0.27	+0.49	2.7	0.94
26	−1.10	0.96	1.72	0.75	3.43	7.1	0.86	0.34	0.62	0.27	−0.90	2.6	0.94
28	+1.76	0.96	1.69	0.82	5.13	6.9	0.81	0.34	0.61	0.30	−0.64	2.5	0.94
Nov. 16	−5.28	0.98	1.37	1.34	−1.08	4.6	0.45	0.26	0.36	0.35	+0.07	1.2	0.94
18	6.12	0.99	1.33	1.40	+1.18	4.3	0.98	0.25	0.33	0.35	1.29	1.1	0.94
20	5.74	0.99	1.29	1.46	+0.26	4.0	0.94	0.23	0.29	0.33	0.90	0.9	0.94
24	−1.80	1.00	1.21	1.54	−1.33	3.3	1.02	0.21	0.24	0.32	+1.53	0.7	0.94
28	+3.55	1.00	1.09	1.64	0.22	2.5	0.81	0.18	0.19	0.28	−0.35	0.4	0.94
Dec. 12	−1.52	1.03	0.68	1.86	0.98	+0.4	0.82	0.07	0.05	0.13	+1.50	0.0	0.95
17	−6.24	1.03	0.52	1.93	0.58	−0.4	0.82	−0.03	+0.02	+0.06	0.43	0.0	0.95
26	+1.46	1.03	−0.21	1.99	4.63	1.9	0.93	+0.04	−0.01	−0.08	+2.27	0.1	0.95
1887 Jan. 7	3.45	1.02	+0.20	1.97	−0.73	4.0	0.96	0.13	+0.02	0.26	−0.21	0.5	0.95
8	+2.13	1.02	0.23	1.96	+0.43	4.1	0.80	0.13	0.03	0.26	+0.70	0.5	0.95
10	−0.75	1.02	0.30	1.95	−0.65	4.4	0.83	0.15	0.05	0.30	0.12	0.7	0.95
15	−6.05	1.00	0.46	1.92	1.20	5.1	0.78	0.19	0.08	0.35	1.65	0.9	0.95
25	+1.73	0.99	0.77	1.78	1.25	6.0	0.78	0.25	0.19	0.44	0.35	1.5	0.95
26	2.91	0.99	0.80	1.77	0.05	6.1	0.81	0.26	0.21	0.46	+0.29	1.6	0.95
28	4.96	0.99	0.86	1.74	1.93	6.3	1.31	0.27	0.23	0.47	−0.05	1.7	1.89
31	6.47	0.99	0.94	1.69	0.99	6.5	0.76	0.29	0.27	0.49	+2.46	1.9	0.95
Feb. 7	+1.32	0.99	1.13	1.55	1.76	6.9	0.79	0.32	0.37	0.50	0.90	2.2	0.95
10	−2.84	0.98	1.20	1.46	1.10	7.0	0.69	0.33	0.41	0.49	+0.01	2.4	0.95
11	3.99	0.98	1.22	1.44	2.63	7.0	0.74	0.34	0.42	0.49	−0.47	2.4	0.95
15	6.22	0.97	1.32	1.36	1.52	7.2	0.69	0.35	0.47	0.49	0.62	2.6	0.95
16	5.88	0.97	1.34	1.34	2.46	7.2	0.72	0.35	0.48	0.49	0.28	2.6	0.95
17	5.46	0.96	1.35	1.31	1.95	7.2	0.77	0.36	0.50	0.49	1.12	2.7	0.95
18	−4.79	0.96	1.37	1.28	2.96	7.2	0.70	0.36	0.51	0.48	−5.05	2.7	0.95
23	+0.68	0.96	1.49	1.16	−1.09	7.4	0.56	0.38	0.58	0.46	+0.88	2.9	0.95
24	1.90	0.96	1.50	1.13	+0.04	7.4	0.76	0.38	0.59	0.44	+0.01	2.9	0.95
26	4.01	0.96	1.54	1.08	−1.76	7.4	0.90	0.38	0.61	0.43	−0.35	2.9	1.89
27	4.85	0.96	1.56	1.05	+3.95	7.5	1.09	0.39	0.63	0.43	0.73	3.0	1.89
28	5.52	0.95	1.57	1.02	−0.77	7.4	1.47	0.39	0.64	0.41	0.09	3.0	1.89
Mar. 1	6.17	0.95	1.58	0.99	2.56	7.4	1.37	0.39	0.65	0.40	−1.78	3.0	1.89
2	+6.16	0.95	1.59	0.96	−3.01	7.4	1.47	0.39	0.65	0.39	+0.75	3.0	1.08
15	−5.76	0.93	1.75	0.60	+1.53	7.0	0.92	0.40	0.76	0.25	−0.61	3.0	1.08
18	5.73	0.93	1.78	0.49	+1.27	6.8	0.40	0.40	0.77	0.20	0.52	3.0	1.08
19	−5.19	0.93	1.78	0.45	−1.85	6.8	1.04	0.40	0.78	0.19	−0.93	3.0	1.08
30	+5.50	0.93	1.84	0.11	0.28	6.0	0.92	0.39	0.78	0.05	+0.11	2.5	1.08
31	5.84	0.93	1.84	0.05	1.87	5.9	0.93	0.39	0.78	0.03	−1.29	2.5	1.08
April 2	5.71	0.93	1.84	−0.02	1.96	5.7	0.93	0.39	0.78	−0.01	−1.64	2.4	1.08
3	5.24	0.93	1.84	+0.02	−1.74	5.6	0.93	0.39	0.78	+0.01	+0.75	2.4	1.08
4	4.48	0.93	1.84	0.05	+0.97	5.5	1.28	0.39	0.78	0.02	−1.15	2.3	1.08
5	3.44	0.93	1.84	0.08	−1.53	5.3	0.67	0.39	0.78	0.03	−3.89	2.3	1.08
7	+0.84	0.93	1.84	0.14	1.25	5.1	0.51	0.38	0.76	0.06	+0.59	2.1	1.08
9	−2.71	0.93	1.84	0.20	1.58	4.9	1.28	0.38	0.76	0.08	−0.08	2.1	1.08
10	2.99	0.93	1.84	0.24	−2.03	4.9	1.30	0.38	0.75	0.10	+0.22	2.0	1.08
15	5.90	0.93	1.82	0.40	+0.97	4.5	1.30	. .	. .	. .	. .	. .	. .
17	5.69	0.93	1.80	0.46	1.13	4.3	1.30	0.36	0.70	0.18	−0.84	1.7	1.08
18	5.14	0.93	1.79	0.48	+0.14	4.2	1.19	0.36	0.69	0.19	0.84	1.6	1.08
20	3.36	0.93	1.78	0.55	−0.28	4.1	1.32	0.35	0.67	0.21	−1.05	1.5	1.08
21	2.26	0.93	1.77	0.59	1.06	3.9	1.32	0.35	0.67	0.22	+0.06	1.5	1.08
22	−1.07	0.93	1.77	0.61	2.46	3.9	1.70	0.35	0.66	0.23	−3.25	1.4	1.08
23	+0.16	0.93	1.77	0.65	1.66	3.7	1.61	0.34	0.65	0.23	1.38	1.3	1.08
24	1.36	0.93	1.76	0.69	−1.20	3.6	0.53	0.34	0.64	0.24	−1.03	1.3	1.08
25	2.53	0.93	1.74	0.71	+0.53	3.4	0.53	0.34	0.63	0.25	+1.48	1.2	1.08
29	5.76	0.93	1.71	0.83	−0.91	2.8	1.59	0.31	0.56	0.26	+0.09	1.0	1.08
May 2	+5.58	+0.93	+1.66	+0.95	−1.00	−2.4	0.94	+0.30	+0.54	+0.30	−2.22	−0.8	1.89

1887	P	E	F	G	$\Delta\alpha \cos\delta$	H	Wt.	J	K	L	$\Delta\delta$	M	Wt.
					″						″		
May 4	+3.99	+0.94	+1.64	+0.98	+0.58	−2.1	1.33	+0.29	+0.52	+0.31	−0.94	−0.7	1.89
5	+2.83	0.94	1.63	1.02	−0.52	1.9	1.33	0.29	0.51	0.32	+2.29	0.6	1.89
9	−2.58	0.94	1.56	1.13	1.10	−1.0	1.47	0.27	0.45	0.33	2.36	−0.3	1.89
26	+4.21	0.95	1.19	1.56	0.71	+1.2	0.59	0.17	0.22	0.29	0.53	+0.2	1.08
27	5.06	0.95	1.16	1.58	0.50	1.3	0.59	0.17	0.21	0.29	+0.87	0.3	1.08
28	5.67	0.95	1.14	1.60	−2.28	1.5	1.96	0.16	0.20	0.28	−0.04	0.3	1.08
29	6.00	0.95	1.11	1.62	+1.07	1.6	1.43	0.16	0.18	0.26	1.19	0.3	1.08
31	5.74	0.95	1.05	1.66	−1.69	1.9	1.32	0.15	0.16	0.25	0.17	0.3	1.08
June 1	5.32	0.95	1.03	1.68	−0.41	2.0	0.60	0.14	0.15	0.24	−0.09	0.3	1.64
2	+4.64	0.96	1.00	1.69	+0.22	2.2	0.60	0.14	0.14	0.24	+0.72	0.3	1.64
6	−0.72	0.96	0.88	1.77	−1.17	2.7	1.03	0.11	0.10	0.20	+0.18	0.3	1.89
7	2.10	0.96	0.85	1.79	0.71	2.9	1.56	0.10	0.09	0.18	−1.21	0.3	1.89
8	3.36	0.96	0.81	1.80	0.23	3.0	1.49	0.10	0.08	0.18	−0.91	0.3	1.89
9	4.58	0.96	0.79	1.82	0.84	3.2	1.27	0.09	0.07	0.16	+1.89	0.3	1.89
10	. .	. .	. .	. .	. .	. .	. .	0.08	0.06	0.15	0.78	0.3	1.89
11	6.12	0.97	0.73	1.86	−0.15	3.5	1.56	0.07	0.05	0.13	+0.81	0.2	1.89
13	6.72	0.97	0.67	1.89	+0.39	3.8	1.47	0.06	0.04	0.11	−1.21	0.2	1.89
14	6.64	0.97	0.64	1.89	−2.02	4.0	2.08	0.05	0.03	0.10	1.17	0.2	1.64
15	6.32	0.97	0.60	1.90	−1.00	4.1	1.92	0.05	0.03	0.10	0.04	0.2	1.64
16	5.66	0.97	0.57	1.91	+0.47	4.3	2.08	0.04	0.02	0.08	0.25	0.2	1.64
17	4.83	0.97	0.54	1.92	−1.41	4.4	2.08	0.03	0.02	0.06	−0.57	0.1	1.64
18	3.82	0.97	0.51	1.93	−1.28	4.6	2.08	0.02	0.01	0.04	+0.42	0.1	1.64
19	2.62	0.97	0.47	1.94	+0.20	4.7	2.08	0.02	+0.01	0.04	−0.20	+0.1	1.64
20	−1.32	0.97	0.43	1.95	−0.99	4.9	1.70	+0.01	0.00	+0.01	+0.31	0.0	1.64
22	+1.40	0.97	0.37	1.96	0.47	5.2	1.30	0.00	0.00	0.00	0.00	0.0	1.64
23	2.54	0.97	0.34	1.97	0.25	5.4	1.24	−0.01	0.00	−0.02	−0.12	−0.1	1.64
24	3.84	0.97	0.30	1.97	1.67	5.5	2.08	0.02	−0.01	0.04	0.64	0.1	1.64
25	5.09	0.97	0.26	1.98	1.94	5.7	2.04	0.02	0.01	0.06	−0.33	0.2	1.64
26	5.55	0.97	0.23	1.98	2.30	5.8	0.61	0.03	0.01	0.06	+1.02	0.2	1.64
27	6.00	0.97	0.20	1.99	0.57	5.9	2.38	0.04	0.01	0.08	+0.41	0.2	1.64
30	5.48	0.97	0.09	2.00	2.45	6.2	2.08	0.06	−0.01	0.12	−0.08	0.4	1.64
July 1	4.71	0.97	0.06	2.00	1.74	6.2	1.82	0.07	0.00	0.14	+0.71	0.4	1.64
2	3.71	0.97	+0.03	2.00	0.94	6.3	1.82	0.08	0.00	0.15	0.91	0.5	1.64
3	2.53	0.97	−0.01	2.00	1.84	6.4	2.17	0.08	0.00	0.16	0.38	0.5	1.64
4	+1.23	0.97	0.05	2.00	0.15	6.4	1.92	0.09	0.00	0.18	+0.20	0.6	1.64
12	−6.58	0.96	0.31	1.95	0.98	6.9	2.00	0.14	+0.04	0.28	−2.11	1.0	1.64
13	6.63	0.96	0.35	1.95	1.31	7.0	2.08	0.15	0.05	0.30	0.61	1.1	1.64
14	6.43	0.96	0.38	1.95	0.82	7.1	2.04	0.16	0.06	0.31	0.85	1.2	1.64
15	5.91	0.96	0.41	1.94	1.64	7.2	1.89	0.16	0.07	0.31	0.65	1.2	1.64
20	−0.56	0.95	0.57	1.87	0.73	7.5	0.59	0.19	0.12	0.38	−0.28	1.5	1.64
21	+0.89	0.95	0.61	1.86	0.77	7.5	1.54	0.19	0.12	0.38	+0.22	1.5	1.64
23	3.40	0.95	0.67	1.84	0.29	7.6	1.30	0.20	0.14	0.40	−0.06	1.6	1.64
24	4.44	0.95	0.71	1.83	2.50	7.7	1.30	0.21	0.16	0.41	+0.31	1.7	1.64
25	5.12	0.95	0.73	1.81	0.60	7.8	1.61	0.22	0.17	0.42	+1.00	1.8	1.64
28	5.90	0.94	0.81	1.76	0.88	8.0	1.72	0.23	0.20	0.43	−0.21	2.0	1.64
29	5.56	0.94	0.85	1.75	2.04	8.1	1.75	0.24	0.22	0.45	+2.20	2.1	1.64
30	4.90	0.94	0.88	1.74	0.25	8.1	1.49	0.25	0.23	0.46	2.09	2.2	1.64
Aug. 1	3.12	0.94	0.94	1.71	0.29	8.1	0.45	0.25	0.25	0.46	1.50	2.2	1.64
2	1.78	0.94	0.96	1.69	0.97	8.1	1.47	0.26	0.27	0.46	0.36	2.2	1.64
3	+0.51	0.94	0.99	1.67	−1.26	8.1	1.47	0.26	0.28	0.46	1.39	2.2	1.64
4	−0.73	0.93	1.02	1.65	+0.02	8.1	1.56	0.27	0.29	0.47	0.31	2.3	1.64
5	2.01	0.93	1.04	1.62	−1.55	8.0	1.75	0.27	0.30	0.47	0.29	2.3	1.64
6	3.06	0.93	1.07	1.59	0.89	8.0	1.52	0.28	0.32	0.48	0.87	2.4	1.64
8	5.08	0.93	1.12	1.57	0.11	8.0	1.72	0.29	0.35	0.48	+1.30	2.5	1.64
9	5.75	0.93	1.14	1.55	2.47	8.0	1.67	0.29	0.36	0.48	−0.21	2.5	1.64
11	6.34	0.93	1.20	1.50	1.96	8.0	1.02	0.30	0.39	0.48	−0.74	2.6	1.64
12	6.27	0.93	1.22	1.48	0.23	7.9	1.82	0.31	0.41	0.49	+0.34	2.7	1.64
15	−4.58	0.93	1.23	1.40	−1.77	7.8	1.70	0.32	0.45	0.49	−2.00	2.7	1.64
22	+4.03	0.92	1.43	1.22	+3.15	7.6	0.29	0.34	0.53	0.46	−0.10	2.8	1.64
23	+4.86	+0.92	−1.45	+1.19	+1.73	+7.5	0.29	−0.34	+0.54	−0.45	+0.89	−2.8	1.64

1887-88	P	E	F	G	$\Delta\alpha \cos\delta$	H	Wt.	J	K	L	$\Delta\delta$	M	Wt.
					″						″		
Aug. 24	+5.48	+0.92	−1.46	+1.17	−0.74	+7.5	1.85	−0.35	+0.56	−0.45	+2.35	−2.9	1.64
25	5.79	0.92	1.48	1.15	−1.32	7.5	1.85	0.35	0.57	0.44	0.00	2.9	1.64
26	5.81	0.92	1.50	1.12	+0.82	7.4	1.45	0.35	0.58	0.43	+0.79	2.9	1.64
28	5.07	0.91	1.53	1.06	−2.06	7.3	0.39	0.36	0.61	0.42	2.45	2.9	1.89
29	4.33	0.91	1.55	1.03	+0.04	7.2	1.10	0.36	0.62	0.41	+1.37	2.9	1.89
30	3.42	0.91	1.56	1.00	−0.27	7.2	0.39	0.36	0.63	0.40	−0.59	2.9	1.89
31	2.35	0.91	1.58	0.98	0.00	7.2	1.10	0.36	0.63	0.39	+0.39	2.9	1.89
Sept. 1	+1.19	0.91	1.60	0.95	−0.30	7.1	1.25	0.37	0.65	0.39	−0.59	2.9	1.89
3	−1.23	0.91	1.62	0.89	−0.59	7.0	0.82	0.37	0.67	0.36	+1.63	2.9	1.89
9	6.00	0.90	1.69	0.71	+0.42	6.3	1.11	0.38	0.72	0.36	+0.67	2.7	1.89
13	4.74	0.90	1.74	0.60	1.18	6.0	0.27	0.39	0.74	0.25	−0.48	2.5	1.89
14	3.88	0.90	1.75	0.57	+1.15	5.9	1.14	0.40	0.76	0.24	0.26	2.5	1.89
15	2.75	0.91	1.76	0.53	−1.54	5.8	1.28	0.40	0.76	0.23	0.38	2.5	1.89
16	2.51	0.91	1.77	0.51	1.51	5.7	1.22	0.40	0.77	0.22	−1.68	2.5	1.89
17	−0.16	0.91	1.78	0.48	0.69	5.6	0.87	0.40	0.77	0.21	+2.15	2.4	1.89
18	+1.24	0.91	1.78	0.44	0.93	5.5	0.87	0.40	0.78	0.19	0.10	2.4	1.89
21	4.63	0.91	1.80	0.35	1.12	5.2	1.06	0.40	0.78	0.15	1.36	2.3	1.89
22	5.34	0.91	1.81	0.32	0.55	5.1	1.33	0.40	0.79	0.14	+1.78	2.2	1.89
23	5.77	0.91	1.81	0.29	0.92	5.0	1.10	0.40	0.79	0.12	−0.52	2.2	1.89
25	5.81	0.91	1.82	0.22	0.64	4.9	1.19	0.40	0.79	0.10	+0.04	2.1	1.89
26	5.42	0.91	1.83	0.19	0.25	4.8	1.06	0.40	0.80	0.08	1.52	2.1	1.89
27	+4.79	0.91	1.83	+0.16	0.84	4.7	0.62	0.40	0.80	−0.07	0.86	2.0	0.94
Oct. 4	. .	. .	. .	. .	. .	. .	. .	0.39	0.78	+0.02	+0.28	1.7	0.94
16	−0.64	0.92	1.80	−0.41	0.50	3.2	0.25	0.37	0.72	0.17	−1.31	1.3	0.94
20	+4.41	0.93	1.78	0.56	0.89	3.1	0.25	0.36	0.68	0.22	2.28	1.2	0.94
22	5.87	0.95	1.77	0.63	2.78	2.6	0.86	0.36	0.66	0.24	0.06	1.0	0.94
23	6.18	0.95	1.76	0.66	2.70	2.6	0.76	0.35	0.65	0.25	−0.46	1.0	0.94
26	5.47	0.95	1.72	0.75	3.01	2.3	0.86	0.34	0.62	0.27	+0.26	0.9	0.94
27	4.78	0.96	1.71	0.78	−3.69	2.2	0.83	0.34	0.61	0.28	−0.01	0.8	0.94
28	+4.03	0.96	1.70	0.81	+1.09	2.2	0.26	0.34	0.60	0.29	+0.53	0.8	0.94
Nov. 1	−0.75	0.96	1.65	0.92	−3.00	2.1	0.70	0.32	0.56	0.31	−0.61	0.7	0.94
2	2.01	0.96	1.63	0.96	1.70	2.1	0.73	0.32	0.55	0.32	−0.65	0.7	0.94
13	−2.71	0.98	1.44	1.27	2.05	1.9	0.87	0.25	0.39	0.34	+1.88	0.5	0.94
16	+1.64	0.98	1.37	1.34	2.80	1.8	0.93	0.24	0.36	0.35	−0.13	0.5	0.94
17	2.98	0.99	1.36	1.36	4.85	1.8	0.74	0.23	0.34	0.34	+0.37	0.5	0.94
26	+4.86	1.00	1.16	1.57	2.49	1.8	0.71	0.18	0.22	0.31	1.75	0.4	0.94
Dec. 11	−4.44	1.03	0.72	1.85	0.47	2.6	0.27	−0.08	+0.06	+0.15	+1.12	−0.2	0.95
23	+6.76	1.03	0.32	1.97	2.48	3.4	0.77	+0.01	0.00	−0.02	−0.03	0.0	0.95
26	4.82	1.03	0.22	1.99	1.10	3.6	0.68	0.03	−0.01	0.06	0.24	+0.1	0.95
27	3.73	1.03	0.18	1.99	1.95	3.7	0.68	0.03	0.01	0.08	1.87	0.1	0.95
29	+1.11	1.03	0.12	2.00	1.71	3.8	0.65	0.06	−0.01	0.12	−0.78	0.2	0.95
1888 31	−1.57	1.03	−0.05	2.00	2.01	4.2	0.68	0.07	0.00	0.14	+0.55	0.3	0.95
Jan. 5	−6.63	1.02	+0.12	2.00	0.11	4.7	0.69	0.11	+0.01	0.22	−0.24	0.5	0.95
13	+0.14	1.01	0.39	1.94	1.91	5.2	0.81	0.18	0.06	0.33	0.21	0.9	0.95
14	1.55	1.01	0.42	1.94	0.24	5.3	0.84	0.18	0.07	0.33	1.80	0.9	0.95
15	2.84	1.00	0.45	1.93	1.21	5.4	0.83	0.19	0.08	0.35	−1.49	1.0	0.95
16	4.06	1.00	0.48	1.92	1.63	5.5	0.86	0.20	0.09	0.37	+0.25	1.1	0.95
25	4.29	1.00	0.77	1.78	1.53	5.9	0.73	0.25	0.19	0.44	−1.92	1.5	0.95
28	+0.74	1.00	0.86	1.75	1.09	6.3	0.40	0.27	0.23	0.47	+0.40	1.7	0.95
29	−0.69	0.99	0.89	1.73	0.09	6.4	0.80	0.27	0.24	0.47	−1.02	1.7	0.95
30	−2.03	0.99	0.91	1.72	3.94	6.5	0.81	0.28	0.26	0.48	1.35	1.8	0.95
Feb. 13	+1.89	0.98	1.27	1.42	0.68	7.9	0.79	0.34	0.44	0.49	1.31	2.7	0.95
14	3.09	0.97	1.29	1.39	−0.97	8.0	0.76	0.35	0.46	0.50	−1.37	2.9	0.95
28	+1.52	0.95	1.58	1.01	+3.01	8.6	0.76	. .	. .	. .	. .	. .	. .
Mar. 2	−4.73	0.95	1.61	0.94	−0.11	8.7	0.93	0.39	0.65	0.38	+0.20	3.6	1.08
4	5.80	0.95	1.64	0.88	0.11	8.9	0.28	0.39	0.67	0.37	0.62	3.7	1.08
8	−4.60	0.94	1.69	0.76	0.26	9.2	1.52	0.39	0.71	0.32	1.62	3.9	1.08
15	+3.25	0.93	1.76	0.55	−2.07	9.6	0.28	0.40	0.76	0.25	1.69	4.2	1.08
21	6.07	0.93	1.80	0.37	+0.48	9.8	0.27	0.40	0.78	0.16	0.30	4.3	1.08
23	+5.09	+0.93	+1.81	−0.31	−1.17	+9.9	0.27	+0.40	+0.79	−0.14	+0.56	+4.3	1.08

1888	P	E	F	G	$\Delta\alpha \cos\delta$	H	Wt.	J	K	L	$\Delta\delta$	M	Wt.
					″						″		
April 8	+3.33	+0.93	+1.84	+0.20	−1.32	+10.0	0.93	+0.38	+0.76	+0.08	−1.82	+4.1	1.08
9	−2.24	0.93	1.84	0.23	+1.06	10.0	0.94	0.38	0.75	0.09	+0.73	4.1	1.08
16	+5.17	0.93	1.80	0.45	−0.14	10.0	0.94	0.36	0.70	0.17	−1.52	3.9	1.08
24	+2.42	0.93	1.74	0.71	1.59	9.9	0.96	0.34	0.63	0.26	+0.50	3.6	1.08
27	−1.67	0.93	1.74	0.79	1.89	9.7	0.30	0.33	0.60	0.28	−1.66	3.4	1.08
29	−4.13	+0.93	+1.69	+0.86	−0.14	+9.6	0.99	+0.31	+0.57	+0.29	−0.70	+3.3	1.08

LEBENSLAUF.

Ich, Henry Allen Peck, Sohn des Kaufmanns Henry C. Peck, wurde am 4 Mai 1863 zu Mexico, N.Y., U.S.A. geboren. Nachdem ich von 1868–74 die Privat und District Schule und von 1874–79 die Mexico Academy meiner Vaterstadt besucht hatte, wurde ich nach einer Unterbrechung meiner Studien durch eine Krankheit im September 1881 an der Universität Syracuse immatriculirt und im Juni 1885 daselbst zum Artium Baccalaureus gemacht. Von 1885 bis 1887 unterrichtete ich in Trigonometrie, Geometrie und Differential und Integralrechnung am Williamsport Dickinson Seminary und wurde nach einer Unterbrechung in welcher ich im Observatorium des Herrn Professor Langleys mit Astronomischen Studien mich beschäftigte, zum Instructor der Mathematik und Astronomie an der Universität Syracuse ernannt. Hier bin ich im Jahre 1888 zum Artium Magister promovirt worden und habe bis 1894 Herrn Professor Dr. French beim Unterricht assistirt.

Meiner eigenen Neigung folgend und auch den Wunsche des Herrn Professor French gemäss erbat ich im Jahre 1894 Urlaub um an einer deutschen Universität mich weiter auszubilden. Ich wählte die Universität zu Strassburg, an der ich vom Winter Semester 1894–95 bis jetzt immatriculirt gewesen bin und den Vorlesungen und practischen Uebungen der Herren Professoren und Docenten Becker, Braun, Heydweiller, Kohlrausch, Mauer, Reye, Roth, Weber und Wislicenus beigewohnt habe.

Allen diesen meinen hochverehrten Lehrern, insbesondere Herrn Professor Becker, spreche ich an dieser Stelle meinen Dank aus.